5-3810-294-10

TM 5-3810-294-10

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

OPERATORS MANUAL
CRANE, TRUCK MOUNTED, 3/4 CUBIC YARDS, 20 TON, w/CLAMSHELL, DRAGLINE AND BACKHOE ATTACHMENTS, G.E.D., (HARNISCHFEGER CORP MODEL M 320T2)
FSN 3810-151-4431

This copy is a reprint which includes current pages from Change 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 1971

D 101.11:

READEX FICHE best copy available

WARNING

REFER TO TB 385-101 BEFORE

OPERATING THIS MACHINE

NEAR HIGH VOLTAGE LINES.

SAFETY PRECAUTIONS

BEFORE AND AFTER OPERATION

When refueling the truck crane, provide a metal to metal contact between the filler nozzle and the gasoline tank. This will prevent sparks which might ignite fuel, and will thus prevent an unsafe condition which might destroy the machine or injure personnel.

Turn radiator cap slowly to allow pressure to escape before removing cap.

Personnel should use care to keep from spilling fuel, coolant, or other liquids upon themselves. Exposed parts of the body should not come into contact with metal during cold weather, as serious and painful injury may result.

Do not crank engine for more than 30 seconds continuously without allowing a 2-minute cooling period. If engine does not start after a few tries, stop cranking. Determine the cause and correct, or report to Organizational Maintenance.

Do not transport the truck crane with the piledriver front-end attachment installed.

Inflate tires from the side opposite the ring. If the ring is improperly installed, air pressure may cause it to fly off the wheel, and serious injury to personnel may result.

While in the park abort condition, the carrier will have no brakes. Always block the wheels so as to prevent truck crane motion before placing the machine in the park abort condition. Do not remove blocking until the carrier is returned to normal brake system operation.

DURING OPERATION

Do not shift the transfer case while the carrier is in motion.

Lower the attachment to the ground before attempting to inspect the boom hoist brake. Serious damage to the equipment or injury to personnel may otherwise result.

Do not attempt to raise the boom by means of the boom hoist lines if the boom tip is below the ground level which supports the carrier. The angle of pull on the boom will be such that the boom may collapse before it can be pulled into the operating position.

The boom hoist pawl must be engaged at all times, except when lowering the boom.

Use care when swinging the revolving frame without a boom, since it will tend to be unbalanced toward the counterweight end.

Do not reply on the ratchet brake locks on the front or rear drum brake pedals to suspend a load. The operator must remain in a position of readiness, with feet on pedals, at all times that a load is suspended.

The boom hoist pawl must be engaged at all times, except when lowering the boom. Do not attempt to engage the boom hoist pawl while lowering the boom.

If there is tension on the tagline, do not release the tagline suddenly. To do so may cause damage to the tagline winder.

The swing brake is not used to stop the revolving frame from swinging while the machine is in operation.

Change in force: C 2

TM 5-3810-294-10
*C 2

CHANGE
NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON DC, *31 December 1981*

OPERATOR'S MANUAL

CRANE, TRUCK MOUNTED, 3/4 CUBIC YARD, 20 TON, W/CLAMSHELL, DRAGLINE, AND BACKHOE ATTACHMENTS, G.E.D., (HARNISCHFEGER CORP MODEL M 320T2) NSN 3810-00-151-4431

TM 5-3810-294-10, 4 May 1971, is changed as follows:

Inside front cover. Warning page is superseded as follows:

WARNING

DEATH ON CONTACT OR SEVERE INJURY may result if personnel fail to observe safety precautions.

HIGH VOLTAGE

Refer to TB 385-101 before operating this machine near high voltage lines.

FIRE HAZARD

When refueling truck-crane, provide metal-to-metal contact between filler nozzle and gasoline tank. This will prevent sparks which might ignite fuel and result in serious injury or death to personnel and destruction of equipment.

DANGEROUS STEAM AND AIR PRESSURE

Turn radiator cap slowly to allow pressure to escape before removing cap. Inflate tires from the side opposite the ring. If ring is improperly installed, air pressure may cause it to fly off the wheel and serious injury to personnel may result.

CAUTION

Do not transport the truck crane with clamshell bucket or drag line attachments installed.

*This change supersedes C 1, 18 April 1973.

Page i. Following chapter 6, section IV add the following:

APPENDIX A. References A-1
APPENDIX B. (Deleted)
APPENDIX C. Additional Authorization List ... C-1
INDEX I-1

Page 1-1, paragraph 1-2 is superseded as follows:

1-2. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Tank-Automotive Command, ATTN: DRSTA-MBP, Warren, MI 48090. A reply will be furnished to you.

Page 1-5, paragraph 1-3*d,* line 6. Change "and is supported at the bottom by a catwalk," to "... has a catwalk attached at the base.".

Page 2-1, prior to paragraph 2-1*b*(2) add the following:

WARNING

When refueling the truck mounted crane, provide a metal-to-metal contact between filler nozzle and gasoline tank. This will prevent sparks which might ignite fuel and result in serious injury or death to personnel and destruction of equipment.

Pages 2-2 through 2-25. Paragraphs 2-3 through 2-9 are reinstated.

Page 2-7, paragraph 2-4*e*(7). Add the following:

CAUTION

Be sure that cable does not drag on the inside rear of the boom point cable guards. Position cable outside the guards when reeving a three or more part line.

Page 2-10, paragraph 2-7*b*(4), line 2. Change "rear" to "front".

line 4. Change "left" to "right".

Paragraph 2-7*b*(5), line 2. Change "front" to "rear".

line 4. Change "right" to "left".

Paragraph 2-7*b*(9), line l. Change "rear" to "front".

Page 2-13, figure 2-18. Change caption "LEFT BOOM POINT SHEAVE" to "RIGHT BOOM POINT SHEAVE", and "RIGHT BOOM POINT SHEAVE" to "LEFT BOOM POINT SHEAVE".

Page 2-25, following paragraph 2-10*b*(11). CAUTION is superseded as follows:

CAUTION

The front drum pawl must be engaged while suspending a load. Operator must visually check the front drum pawl to insure that it is engaged while suspending a load. Do not attempt to engage this pawl while lowering a load.

Following paragraph 2-10*b*(12). CAUTION is superseded as follows:

CAUTION

The rear drum pawl must be engaged while suspending a load. Operator must visually check the rear drum pawl to insure that it is engaged while suspending a load. Do not attempt to engage this pawl while lowering a load.

Page 2-34. Before paragraph 2-15*a* add the following:

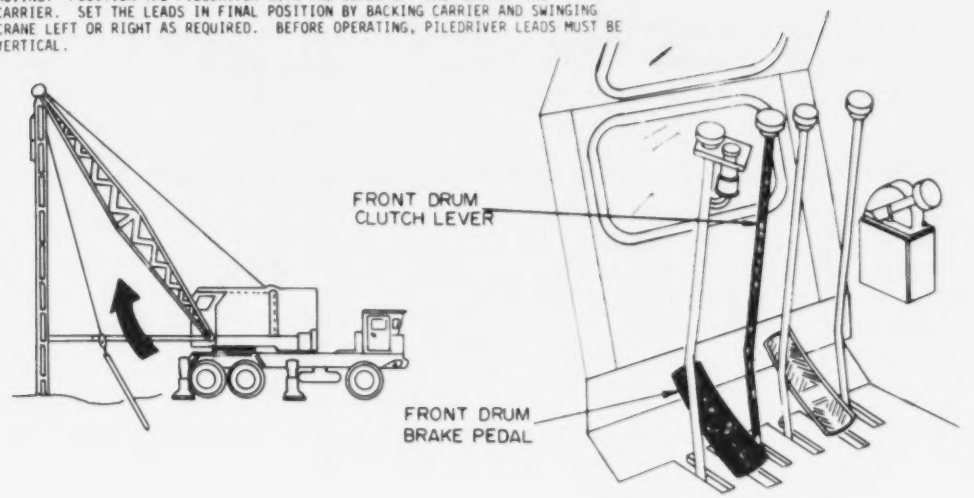
WARNING

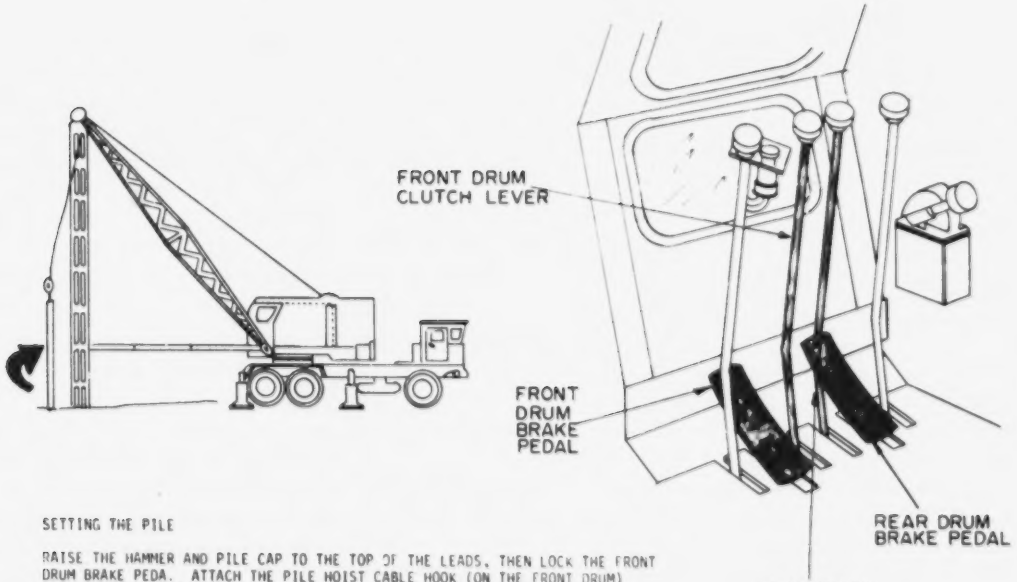
HIGH VOLTAGE. Refer to TB 385-101 before operating this equipment near high voltage lines.

Page 2-44. **Figure 2-39 (sheet 1 of 2) is superseded as follows:**

POSITIONING THE PILEDRIVER

HOOK THE PILE CAP SLINGS IN THE HAMMER LUGS. PULL THE FRONT DRUM LEVER BACK TO RAISE THE HAMMER AND PILE CAP IN THE LEADS. APPLY THE FRONT DRUM BRAKE PEDAL AND RELEASE THE FRONT DRUM LEVER. MOVE THE CARRIER SLOWLY TO POSITION THE PILEDRIVER. WHEN MOVING, WATCH THAT THE LEADS DO NOT BOTTOM ON THE GROUND. MAKE SURE BOOM IS CLEAR OF POWER LINES OR OVERHEAD OBSTRUCTIONS. FOR INCREASED STABILITY, KEEP THE HAMMER AND CAP LOW IN THE LEADS WHILE MOVING. POSITION THE PILEDRIVER WITH THE LEADS OFF THE REAR OF THE CARRIER. SET THE LEADS IN FINAL POSITION BY BACKING CARRIER AND SWINGING CRANE LEFT OR RIGHT AS REQUIRED. BEFORE OPERATING, PILEDRIVER LEADS MUST BE VERTICAL.





SETTING THE PILE

RAISE THE HAMMER AND PILE CAP TO THE TOP OF THE LEADS, THEN LOCK THE FRONT DRUM BRAKE PEDA. ATTACH THE PILE HOIST CABLE HOOK (ON THE FRONT DRUM) TO THE TOP OF THE PILE. DRAG THE PILE UP INTO THE LEADS BY PULLING BACK ON THE FRONT DRUM LEVER. WHEN THE PILE IS VERTICAL IN THE LEADS, LOWER THE HAMMER AND CAP, GUIDING THE TOP OF THE PILE INTO THE HOLLOW IN THE BOTTOM OF THE PILE CAP. SET THE POINT OF THE PILE IN PLACE ON THE GROUND AND REST THE HAMMER AND CAP ON TOP OF THE PILE. DROP THE SLING HOLDING THE PILE CAP TO THE HAMMER. BE SURE THE PILE IS VERTICAL. DISCONNECT THE PILE HOIST CABLE. STORE THE CABLE FOR EASY ACCESS. THE PILE WILL BE HELD IN POSITION BY THE PILE CAP.

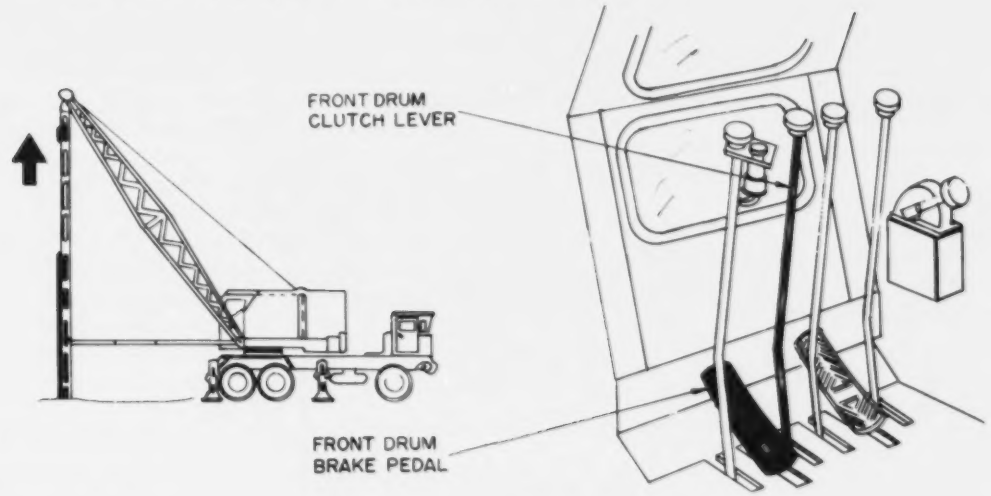
TA 072663

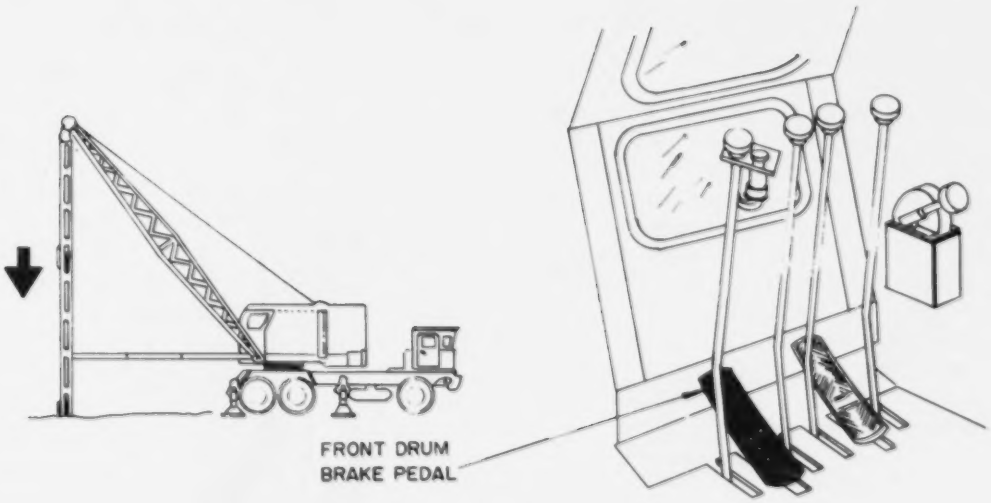
Figure 2-39. Piledriver operation and control positions (sheet 1 of 2).

Page 2-45. Figure 2-39 (sheet 2 of 2) is superseded as follows:

LIFTING THE HAMMER

PULL THE FRONT DRUM LEVER BACK TO RAISE THE HAMMER. APPLY THE FRONT DRUM BRAKE PEDAL AND RELEASE THE FRONT DRUM LEVER WHEN HAMMER REACHES DESIRED HEIGHT.





DROPPING THE HAMMER

RELEASE THE FRONT DRUM BRAKE PEDAL TO DROP THE HAMMER.

DRIVING THE PILE

LIFT THE HAMMER A SHORT DISTANCE AND DROP THE HAMMER. JUST AS THE HAMMER REACHES THE WOODEN PILE CAP PLUG, STEP ON THE FRONT DRUM BRAKE PEDAL TO KEEP THE HOIST CABLE FROM UNREELING. MAKE THE FIRST SERIES OF BLOWS ON THE PILE LIGHT ONES SO THE PILE WILL BE STARTED INTO THE GROUND EVENLY. CHECK THAT THE PILE IS STRAIGHT. IF THE PILE IS ANGLED AND NOT TOO DEEP, MOVE THE CRANE TO STRAIGHTEN IT. AFTER THE PILE IS STARTED, RAISE THE HAMMER TO THE TOP OF THE LEADS, DROP IT AND APPLY THE FRONT DRUM BRAKE AS INSTRUCTED ABOVE. REPEAT THE ACTION UNTIL THE PILE IS DRIVEN TO THE DESIRED DEPTH. SLING THE PILE CAP TO THE HAMMER, RAISE THE HAMMER, POSITION THE PILEDRIVER OVER THE NEXT PILE SITE, AND REPEAT THE CYCLE.

TA 072664

Figure 2-39. Piledriver operation and control positions (sheet 2 of 2).

Page 2-49, paragraph 2-20*a*, line 2 and 3. Delete "as described in paragraph 2-9".

Page 2-52, paragraph 2-21.

Subparagraph *a* is changed to read as follows:

a. General. The truck crane can be transported readily, as it is mounted on its own carrier. Before moving the equipment, obtain information on road conditions and possible restrictions along the route due to clearances. Secure the crane cab by disengaging all clutches, setting all brakes, and installing the anti-rotation bars that brace the upper to the carrier frame. Refere to figure 2-42.

CAUTION

DO NOT TRANSPORT THE TRUCK CRANE WITH CLAMSHELL BUCKET DRAGLINE ATTACHMENTS, OR THE PILEDRIVER FRONT-END ATTACHMENT INSTALLED.

Subparagraph (1). Deleted.

Subparagraph (2). Deleted.

Paragraph 2-22. Title is changed to read as follows:

2-22. Fire Extinguisher (Monobromotrifluoromethane)

Page 3-1. Section II is superseded as follows:

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (CRANE)

3-3. General

Preventive maintenance is detecting/correcting problems before they happen, or fixing little problems before they become big problems. Table 3-1 contains a list of preventive maintenance checks and services to be performed by operator/crew. Attention to these checks and services will increase the useful life of the equipment, but every possible problem cannot be covered in the PMCS. You need to be alert for anything that might cause a problem.

3-4. Maintenance Forms and Records

Every mission begins and ends with the paperwork. There isn't much of it, but you have to keep it up. The forms and records you fill out have several uses. They are a permanent record of the services, repairs, and modifications made on your equipment. They are reports to organizational maintenance and to your commander. And they are a checklist for you when you want to know what is wrong with the equipment after its last use, and whether those faults have been fixed. For the information you need on forms and records, see TM 38-750.

3-4.1. Preventive Maintenance Checks and Services

a. Do your (B) PREVENTIVE MAINTENANCE just before you operate the equipment. Pay attention to the CAUTIONS and WARNINGS.

b. Do your (D) PREVENTIVE MAINTENANCE during operation. (During operation means to monitor the crane while it is actually being used).

c. Do your (A) PREVENTIVE MAINTENANCE right after operating the equipment. Pay attention to the CAUTIONS and WARNINGS.

d. Do your (W) WEEKLY PREVENTIVE MAINTENANCE weekly.

e. Do your (M) MONTHLY PREVENTIVE MAINTENANCE once a month.

f. If something doesn't work, troubleshoot it with the instructions in this manual or notify your supervisor.

g. Always do your PREVENTIVE MAINTENANCE in the same order, so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

h. If anything looks wrong and you can't fix it, write it on your DA Form 2404. If you find something seriously wrong, report it to organizational maintenance RIGHT NOW.

i. When you do your PREVENTIVE MAINTENANCE, take along the tools you need to make all the checks. You always need a rag or two.

WARNING

Drycleaning solvent SD-2, used to clean parts, is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 138° F.

(1) *Keep it clean.* Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use drycleaning solvent (SD-2) to clean metal surfaces. Use soap and water when you clean rubber or plastic material.

(2) *Bolts, nuts, and screws.* Check them all for obvious looseness, missing, bent, or broken condition. You can't try them all with a tool, of course, but look for chipped paint, bare metal, or rust around bolt heads. If you find one you think is loose, tighten it or report it to organizational maintenance.

(3) *Welds.* Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to organizational maintenance.

(4) *Electric wires and connectors.* Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure the wires are in good shape.

(5) *Hoses and fluid lines.* Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots show leaks, of course, but a stain around a fitting or connector can mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to organizational maintenance.

j. It is necessary for you to know how fluid leakage affects the status of your equipment. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your equipment. Learn, then be familiar with them and REMEMBER—WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR!

Leakage definitions for Operator/Crew PMCS

CLASS I Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

CLASS II Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.

CLASS III Leakage of fluid great enough to form drops that drip from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakage (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS.

Class III leaks should be reported to your supervisor or to organizational maintenance.

Table 3-1. Preventive Maintenance Checks and Services (Crane)

B—Before D—During A—AFter W—Weekly M—Monthly

Item no.	Interval B	D	A	W	M	ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed	Equipment is not ready/ available if:
						NOTE PERFORM WEEKLY AS WELL AS BEFORE PMCS IF: *a.* You are the assigned driver but have not operated the crane since the last weekly. *b.* You are operating the crane for the first time.	
1						MAKE THE FOLLOWING WALK AROUND CHECKS: (Exterior of vehicle)	
	•					*a.* Check for evidence of leakage (oil, fuel, hydraulic fluid, or coolant) on or under the crane.	Class III leakage is evident (no fuel leakage allowed).
	•					*b.* Visually check for loose, missing, or damaged parts.	Missing parts affecting safe operation
	•					*c.* Check the fire extinguisher is in proper place and and seal is not broken.	Seal broken or discharged
2	•					RADIATOR Check coolant level. Level should be maintained to the bottom of the fill pipe.	
3				•		BATTERIES *a.* Check level of electrolyte. If low, fill with clean water (distilled if possible) to the split ring. In freezing weather, run engine at least 15 minutes after adding water.	
				•		*b.* Inspect for cracks and leaks.	
				•		*c.* Check cables for clean and tight connections.	
4				•		HYDRAULIC FLUID RESERVOIR Check level and add fluid if necessary.	
5						GAUGES AND INSTRUMENTS Check gauges for the following normal readings:	
		•				*a.* Coolant temperature ..... 160° F to 200° F.	Pressure/temperature indications not within ranges specified.
		•				*b.* Engine oil pressure ..... 35 to 45 psi.	
		•				*c.* Trachometer ..... 1955 to 2005 rpm.	
		•				*d.* Voltmeter ..... change (13.3 to 15.2V).	
6						CONTROLS With the unit running, operate each control. Insure that the controls function properly.	
		•				*a.* Check swing clutch lever for proper operation.	Evidence of clutch or brake slippage that would pose a threat to workers, loads, or material.
		•				*b.* Check swing brake lever for proper operation.	
		•				*c.* Check front drum clutch lever for proper operation.	
		•				*d.* Check front drum brake pedal for proper operation.	
		•				*e.* Check rear drum clutch lever for proper operation.	Binding or abnormal noise.
		•				*f.* Check rear drum brake pedal for proper operation.	
		•				*g.* Check boom hoist clutch and brake lever for proper operation.	Six broken wires in one rope lay or three broken wires in one strand of one rope lay.

Table 3-1. Preventive Maintenance Checks and Services (Crane)—continued

B—Before D—During A—AFter W—Weekly M—Monthly

Item no.	Interval					ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed	Equipment is not ready/ available if:
	B	D	A	W	M		
7				•		CABLES Check for signs of wear or damage.	or four percent of total number of wires in rope, in length of one rope lay. (TB 43-0142) unserviceable end connection Improper reeving
8					•	BOOM AND/OR JIB Visually inspect for damage such as cracks or breaks.	Boom bent, cracked or broken
9					•	SHEAVES AND HOOK BLOCK Visually inspect for damage such as cracks or breaks.	Hook is cracked.

Page 3-4, table 3-2.

Malfunction 1. Delete step 4.

Malfunction 2, step 2. Change "add coolant:" to "add coolant to bring level to 3/4-inch above radiator baffle plate".

Page 3-5, paragraph 3-7. Delete entire paragraph.

Page 3-8.

Figure 3-3. Change "STEP 3." to "*WARNING*"

Page 3-9.

Paragraph 3-15*a*. Change "CAUTION" to "WARNING".

3-16. Distributor Service

Deleted

Figure 3-6. Distributor service.

Deleted

Page 3-11. Paragraph 3-23 is superseded as follows:

3-23. Transmission Inspection and Service

Refer to figure 3-8 and inspect the transmission breather cap for cleanliness. If necessary, rinse the cap in clean diesel fuel or kerosene and allow to drain dry before replacing. Inspect the transmission for signs of oil leaks or other damage. Report any deficiencies to organizational maintenance.

Figure 3-8. Delete steps 2 through 4.

Page 3-12.

Paragraph 3-27. Delete entire paragraph.

Pages 3-13 through 3-16.

Delete figures 3-10, 3-11, 3-12, and 3-13.

Page 3-17. Paragraph 3-28.

Subparagraphs *d*, *e*, *f*, *g*, and *h* are deleted.

Delete figures 3-16 and 3-17.

Page 3-20.

Paragraph 3-29. Delete entire paragraph.

Delete figure 3-18.

Paragraph 3-30. Delete entire paragraph.

Page 3-21.

Paragraph 3-31*c*. Delete entire paragraph.

Paragraph 3-32. Delete entire paragraph.

Page 3-22, figure 3-19. Deleted.

Page 3-23.

Paragraph 3-33. Delete entire paragraph.

Paragraph 3-34. Delete entire paragraph.

Page 3-24, figure 3-20. Deleted.

Page 3-25, paragraph 3-35. Delete entire paragraph.

Page 3-26.

Figure 3-21. Deleted.

Paragraph 3-36. Delete entire paragraph.

Page 3-27.

Figure 3-22. Deleted.

Paragraph 3-38. Delete entire paragraph.

Page 3-28.

Figure 3-23. Deleted.

Paragraph 3-39. Delete entire paragraph.

Page 3-29, figure 3-24. Deleted.

Page 3-30, figure 3-25. Deleted.

Page 3-31, paragraph 3-40. Delete entire paragraph.

Page 3-32, figure 3-26. Deleted.

Page 3-33.

Figure 3-27. Deleted.

Paragraph 3-42. Delete entire paragraph.

Page 5-2.

Paragraph 5-2*b*(37). Change "(item 36)" to "(item 34)".

Key to figure 5-1, item 36. Change "Accelerometer pedal" to "Accelerator pedal".

Page 5-6, paragraph 5-6*c*. Change "fast idle (approx. 650 to 750 rpm)" to "fast idle speed (1000 to 1300 rpm)".

Page 6-1, Section II is superseded as follows:

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (CARRIER)

6-3. General

Preventive maintenance is detecting/correcting problems before they happen, or fixing little problems before they become big problems. Table 6-1 contains a list of preventive maintenance checks and services to be performed by operator/crew. Attention to these checks and services will increase the useful life of the equipment, but every possible problem cannot be covered in the PMCS. You need to be alert for anything that might cause a problem.

6-4. Maintenance Forms and Records

Every mission begins and ends with the paperwork. There isn't much of it, but you have to keep it up. The forms and records you fill out have several uses. They are a permanent record of the services, repairs, and modifications made on your equipment. They are reports to organizational maintenance and to your commander. And they are a checklist for you when you want to know what is wrong with the equipment after its last use, and whether those faults have been fixed. For the information you need on forms and records, see TM 38-750.

6-4.1. Preventive Maintenance Checks and Services

a. Do your (B) PREVENTIVE MAINTENANCE just before you operate the equipment. Pay attention to the CAUTIONS and WARNINGS.

b. Do your (D) PREVENTIVE MAINTENANCE during operation. (During operation means to monitor the carrier while it is actually being used).

c. Do your (A) PREVENTIVE MAINTENANCE right after operating the equipment. Pay attention to the CAUTIONS and WARNINGS.

d. Do your (W) WEEKLY PREVENTIVE MAINTENANCE weekly.

e. Do your (M) MONTHLY PREVENTIVE MAINTENANCE once a month.

f. If something doesn't work, troubleshoot it with the instructions in this manual or notify your supervisor.

g. Always do your PREVENTIVE MAINTENANCE in the same order, so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

h. If anything looks wrong and you can't fix it, write it on your DA Form 2404. If you find something seriously wrong, report it to organizational maintenance RIGHT NOW.

i. When you do your PREVENTIVE MAINTENANCE, take along the tools you need to make all the checks. You always need a rag or two.

WARNING

Drycleaning solvent SD-2, used to clean parts, is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 138° F.

(1) *Keep it clean.* Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use drycleaning solvent (SD-2) to clean metal surfaces. Use soap and water when you clean rubber or plastic material.

(2) *Bolts, nuts, and screws.* Check them all for obvious looseness, missing, bent, or broken condition. You can't try them all with a tool, of course, but look for chipped paint, bare metal, or rust around bolt heads. If you find one you think is loose, tighten it or report it to organizational maintenance.

(3) *Welds.* Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to organizational maintenance.

(4) *Electric wires and connectors.* Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure the wires are in good shape.

(5) *Hoses and fluid lines.* Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots show leaks, of course, but a stain around a fitting or connector can mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to organizational maintenance.

j. It is necessary for you to know how fluid leakage affects the status of equipment. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your equipment. Learn, then be familiar with them and REMEMBER—WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR!

Leakage definitions for Operator/Crew PMCS

CLASS I	Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
CLASS II	Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.
CLASS III	Leakage of fluid great enough to form drops that drip from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakage (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS.

Class III leaks should be reported to your supervisor or to organizational maintenance.

Table 6-1. Preventive Maintenance Checks and Services (Carrier)

B—Before D—During A—AFter W—Weekly M—Monthly

Item No.	Interval					ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed	Equipment is not ready/ available if:
	B	D	A	W	M		
						NOTE PERFORM WEEKLY AS WELL AS BEFORE PMCS's IF: *a.* You are the assigned driver but have not operated crane carrier since the last weekly. *b.* You are operating the carrier for the first time.	
1						MAKE THE FOLLOWING WALK AROUND CHECKS: (Exterior of vehicle)	
	•					*a.* Check for evidence of leakage (oil, fuel, hydraulic fluid, or coolant) on or under the vehicle.	Class III leakage is evident (no fuel leakage allowed).
	•					*b.* Check tires for damage or low pressure (correct pressure is 75 psi).	Tires have cuts or abrasions which would result in tire failure during operation. One or more tires missing or unserviceable.
	•					*c.* Check that fire extinguisher is in proper place and has proper pressure. Needle on gage should be in white area.	Needle not in white area.
	•					*d.* Visually check for loose, missing, or damaged parts.	Loose missing or damaged wheels or outriggers.
2	•					RADIATOR Check coolant level. Level should be maintained to bottom of the fill pipe.	
3						BATTERIES	
				•		*a.* Check level of electrolyte. If low, fill with clean water (distilled if possible) to the split ring. In freezing weather, run engine at least 15 minutes after adding water.	
				•		*b.* Inspect for cracks and leaks.	
				•		*c.* Check cables for clean and tight connections.	
4						GAUGES AND INSTRUMENTS Check gauges for the following normal readings:	
		•				*a.* Coolant temperature ..... 160° to 200° F.	Pressure/temperature gages not within ranges specified.
		•				*b.* Engine oil pressure ..... 35 to 45 psi.	
		•				*c.* Voltmeter—charge (13.3 to 15.2V).	
		•				*d.* Tachometer—3100 rpm (Max).	
5		•				LIGHTS Check for proper operation.	
6		•				SERVICE BRAKES During operation, check brakes for stopping ability. Note any pulling, grabbing, or other abnormal conditions.	Stopping ability impaired. Abnormal operation that would result in hazardous driving conditions.

Page 6-2, table 6-2.
Malfunction 1. Delete step 4.
Malfunction 10. Deleted.

Page 6-3.
Paragraph 6-7. Delete entire paragraph.
Paragraph 6-10. Delete entire paragraph.
Delete figure 6-1.

Page 6-4.
Paragraph 6-14. Change "CAUTION:" to "WARNING:"
Figure 6-3. Change "CAUTION:" to "WARNING:"

Page 6-5.
Paragraph 6-20*a*, line 5. Change "Direct Support

Maintenance" to "Organizational Maintenance".

Paragraph 6-21*a*, line 4. Change "Direct Support Maintenance" to "Organizational Maintenance".

Paragraph 6-23. Delete entire paragraph.

Paragraph 6-24, line 4. Change "Direct Support Maintenance" to "Organizational Maintenance".

Paragraph 6-25, line 3. Change "General Support Maintenance" to "Organization Maintenance".

Page 6-6.

Paragraph 6-28*b*, line 7. Delete "6-10".

Paragraph 6-30*a*. Change "TM 9-1870-1" to "TM 9-2610-200-20".

Paragraphs 6-31 and 6-32. Delete entire paragraph.

Page 6-7.

Paragraph 6-36. Delete entire paragraph.

Paragraph 6-37. Delete entire paragraph.

Figure 6-8. Delete figure.

Paragraph 6-41. Delete entire paragraph.

Paragraph 6-42. Delete entire paragraph.

Page A-1.

Paragraph A-4. Change "TM 9-1870-1" to "TM 9-2610-200-20".

Paragraph A-5. Change "TB-740-93-2" to "TB-740-97-2".

Page B-1, appendix B-1. Delete entire appendix.

Page B-4. Appendix C is added as follows:

APPENDIX C
ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

C-1. Scope

This appendix lists additional items you are authorized for the support of the Truck Mounted Crane.

C-2. General

This list identifies items that do not have to accompany the Truck Mounted Crane and that do not have to be turned in with it. These items are authorized to you by CTA, MTOE, TDA, or JTA.

C-3. Explanation of Listing

National stock numbers, descriptions, and quantities are provided to help you to identify and request the additional items you require to support this equipment.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) National Stock Number	(2) Description Part number & FSCM / Usable on Code	(3) U/M	(4) Qty Auth
7520-00-559-9618	CASE, MAINTENANCE AND OPERATION MANUALS	EA	1
2590-00-505-6736	CASE, RIFLE	EA	1
4210-00-889-2221	EXTINGUISHER, FIRE	EA	2

Alphabetical index is added as follows:

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Air brake reservoir inspection	6-26	6-6
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By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25B Operator maintenance requirements for Cranes: Truck Mounted.

TECHNICAL MANUAL

NO. 5-3810-294-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C. *4 May 1971*

OPERATORS MANUAL

CRANE, TRUCK MOUNTED, ¾ CUBIC YARDS, 20 TON, W/ CLAMSHELL, DRAGLINE AND BACKHOE ATTACHMENTS, G.E.D., (HARNISCHFEGER CORP MODEL M 320T2) FSN 3810-151-4431

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PART ONE

(CRANE (REVOLVING FRAME)

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Purpose and Scope

a. This manual is for your use in operating and maintaining the Harnischfeger truck crane model M320T2.

b. The manual is divided into two parts. Part One contains instructions for the operation and maintenance of the crane (revolving frame) portion of the machine. Part Two is for the operation and maintenance of the carrier portion of the machine.

c. Operator / Crew personnel should read the instructions provided in both parts of this manual before operating, servicing or maintaining this equipment.

1-2. Recommending Improvement

You can improve this manual by recommending improvements, using DA Form 2028 (Recommended Changes to Publications) or a letter, and mail directly to Commanding General, U. S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Blvd., St. Louis, Mo. 63120. A prompt reply will be furnished directly to you.

Section II. DESCRIPTION AND DATA

1-3. Description

a. General. The Harnishfeger model M320T2 truck crane is designed for universal operation, and may be converted for use as a crane (fig. 1-1 and 1-2), clamshell (fig. 1-3), dragline (fig. 1-4), piledriver (fig. 1-5), backhoe (fig. 1-6) or shovel (fig. 1-7). The front-end attachments are described, and detailed instructions for the operation of each attachment are given in chapter 2 of this manual. The military load class is E-29.

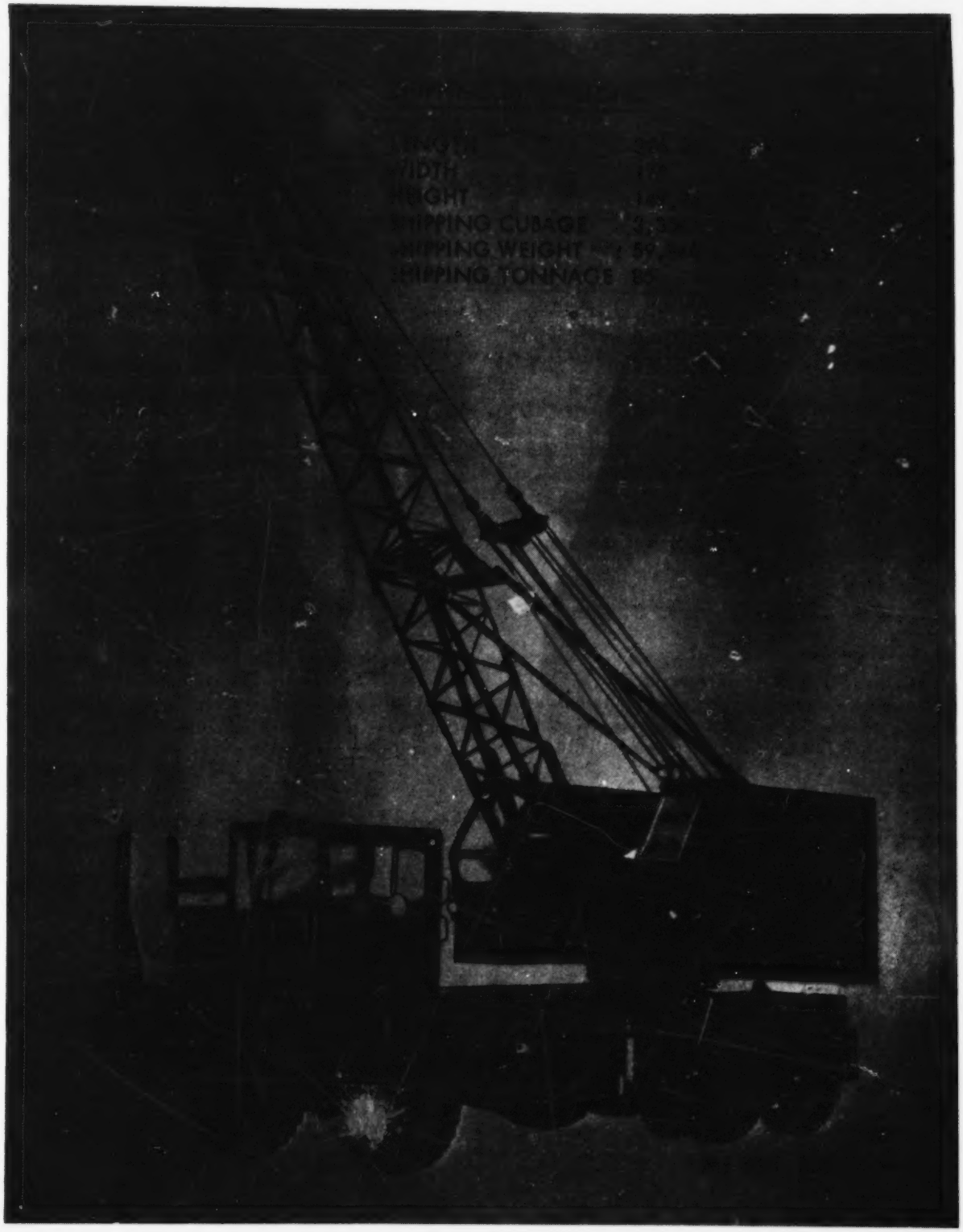
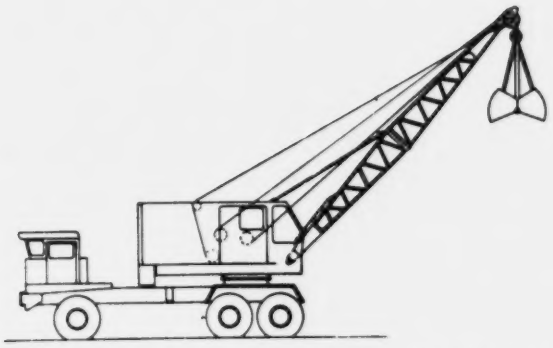


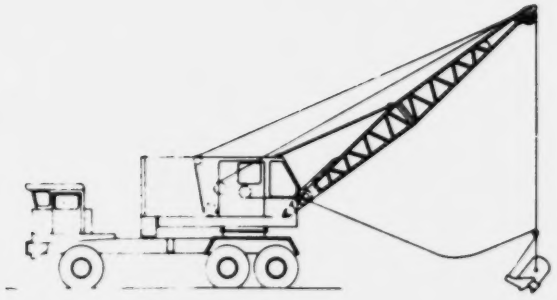
Figure 1-1. Truck crane model M320T2 with crane attachment, front three-quarter view and shipping dimensions.

Figure 1-2. Truck crane model M320T2 with crane attachment, rear three-quarter view.



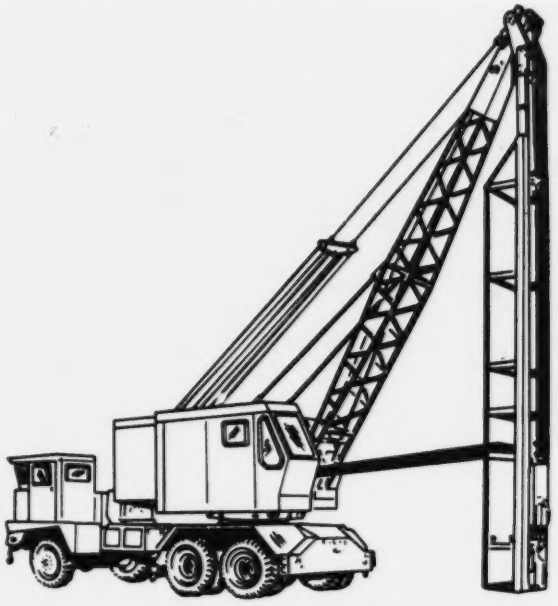
ME 3810-288-12/1-3

Figure 1-3. Clamshell attachment.



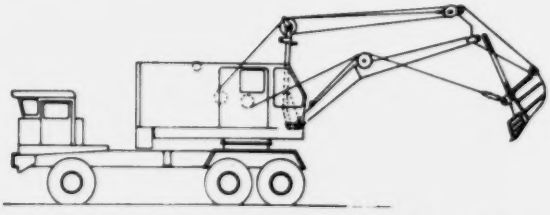
ME 3810-288-12/1-4

Figure 1-4. Dragline attachment.



ME 3810-288-12/1-5

Figure 1-5. Piledriver attachment.



ME 3810-288-12/1-6

Figure 1-6. Backhoe attachment.

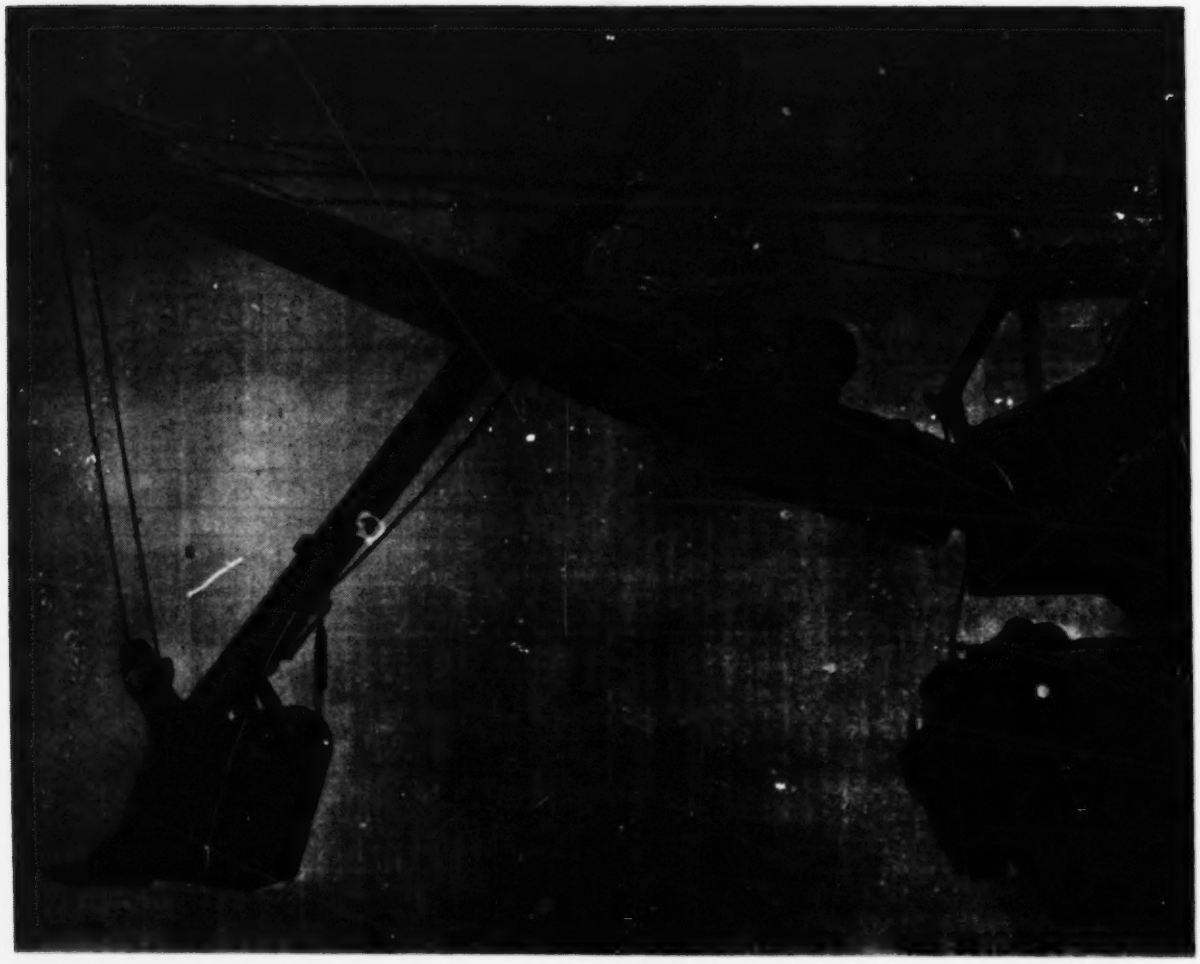


Figure 1-7. Shovel attachment.

b. Crane. The crane includes a revolving frame, rotating machinery, gasoline engine, and an operator's cab. Lugs are provided at the front of the revolving frame, to which the front-end attachments are installed. A counterweight is installed at the rear of the revolving frame. The carrier on which the crane is mounted is described in paragraph 4-3 of this manual.

c. Crane Attachment. The crane boom is used with a hook block to lift, swing, and position heavy loads. It is used also in conjunction with the clamshell and dragline buckets, and the piledriver. The clamshell bucket (fig. 1-3) or dragline bucket (fig. 1-4) may be installed on the crane boom for excavating or moving loose material. Boom inserts are used to increase the boom length, or to extend the working range of the crane.

d. Piledriver Attachment. The piledriver attachment (fig. 1-5) is used in conjunction with the crane boom and is used for driving piling into the ground in the construction of foundations, piers, and bases. The piledriver is attached to the crane boom point and is supported at the bottom by a catwalk.

e. Backhoe Attachment. The backhoe attachment (fig. 1-6) is designed to work below the ground level by pulling the dipper toward the machine, and is used for digging trenches, ditches, and similar excavations.

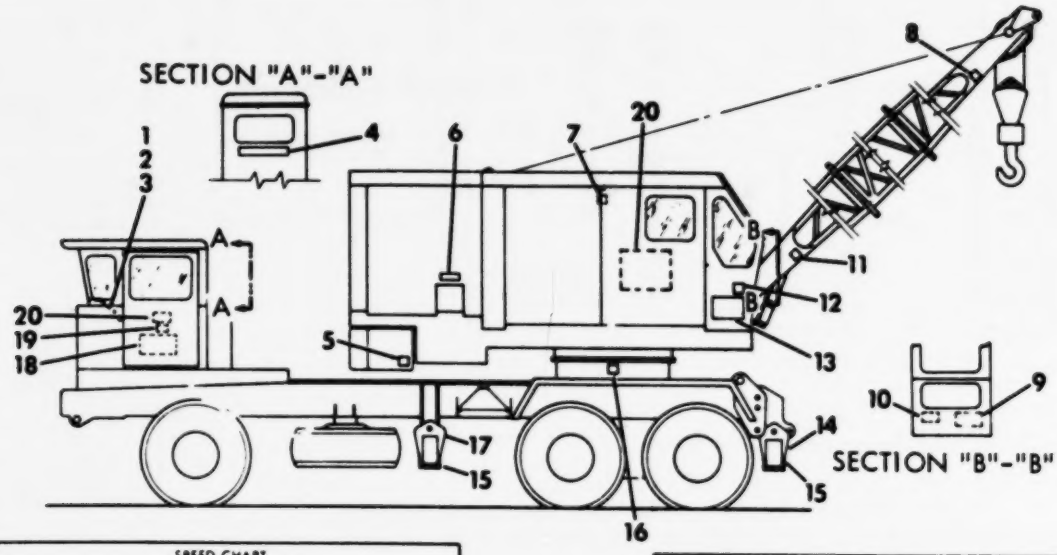
f. Shovel Attachment. The shovel attachment (fig. 1-7) is designed to work above ground level by lifting the dipper upward and outward, and is used for digging into the side of a hill or bank.

g. Additional Components. If you need a detailed

description of any components of the M320T2 truck crane, refer to TM 5-3810-294-20.

1-4. Tabulated Data

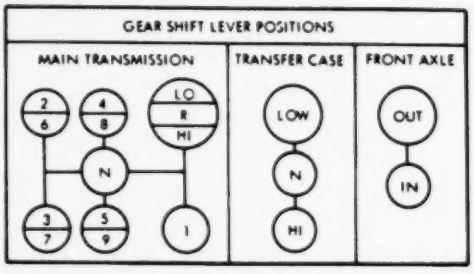
a. Identification and Instruction Plates. Figure 1-8 shows the location of all major instruction and identification plates. Each such plate is numbered and illustrated as a portion of this illustration.



SPEED CHART

GEAR	ON HWY.	OFF HWY.	CAUTION-TO AVOID OVER SPEEDING ENGINE, DO NOT ALLOW SPEED TO EXCEED THAT SHOWN FOR GEAR COMBINATION USED. FOR BEST PERFORMANCE- SHIFT UP WHEN SPEED REACHES VALUE SHOWN FOR GEAR USED. SHIFT DOWN WHEN SPEED DROPS TO VALUE SHOWN FOR NEXT LOWER GEAR
9th	35.0	17.0	
8th	27.0	13.6	
7th	20.0	10.5	
6th	16.0	8.1	
5th	12.1	6.2	
4th	9.6	4.8	
3rd	7.3	3.6	
2nd	5.7	2.8	
1st	3.7	1.8	

REF. 1

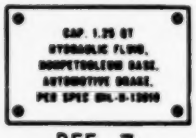


REF. 2

PARK ABORT CONTROL
OPERATION
1 RELEASE ALL BRAKES.
2 MINIMUM OPERATING AIR PRESSURE 75 P.S.I.
3 PUSH CONTROL BUTTON DOWN FIRMLY AND RELEASE.
VALVE AUTOMATICALLY RESETS

REF. 3

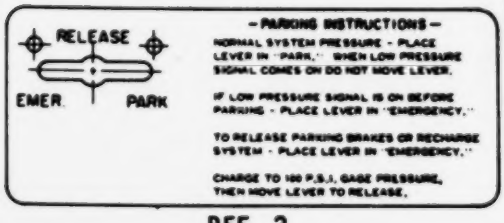
REF. 4



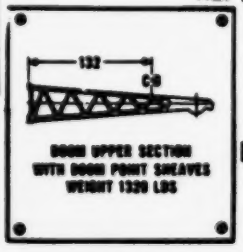
REF. 7

REF. 5

REF. 6


RELEASE
EMER.
PARK
—PARKING INSTRUCTIONS—
NORMAL SYSTEM PRESSURE - PLACE LEVER IN "PARK." WHEN LOW PRESSURE SIGNAL COMES ON DO NOT MOVE LEVER.
IF LOW PRESSURE SIGNAL IS ON BEFORE PARKING - PLACE LEVER IN "EMERGENCY."
TO RELEASE PARKING BRAKES OR RECHARGE SYSTEM - PLACE LEVER IN "EMERGENCY."
CHARGE TO 100 P.S.I. GAGE PRESSURE, THEN MOVE LEVER TO RELEASE.

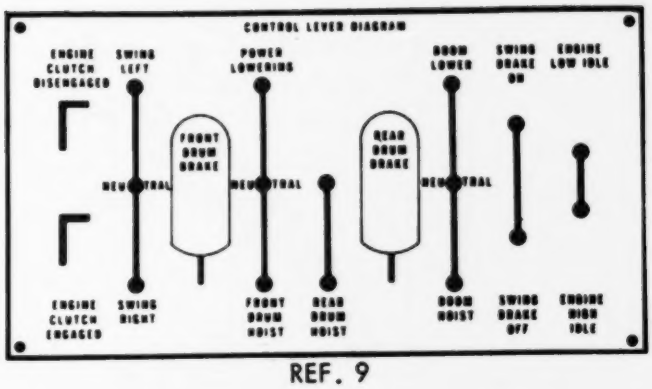
REF. 3



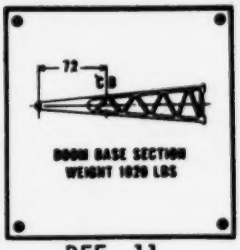
REF. 8

ME 3810-294-10/1-8①

Figure 1-8. Identification and instruction plates (sheet 1 of 4).



REF. 9



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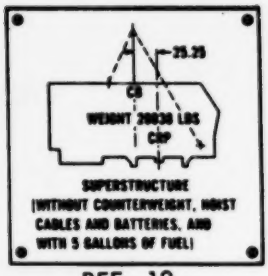

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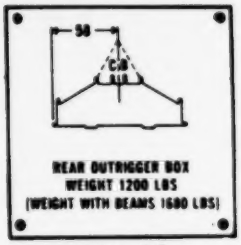
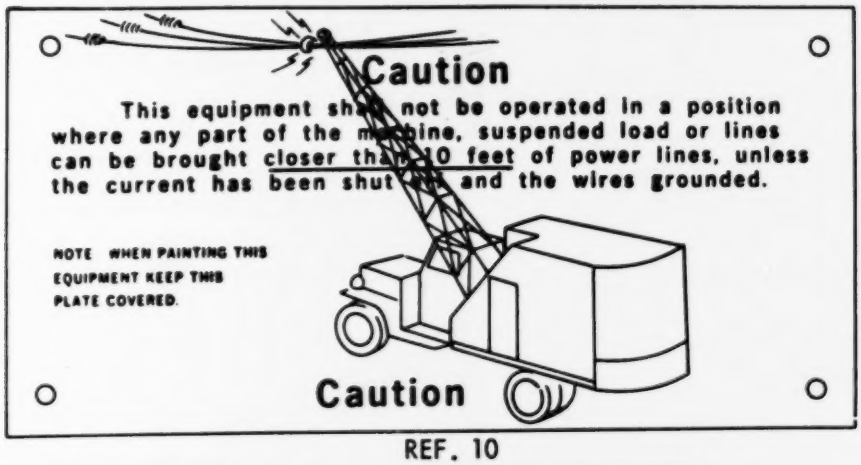
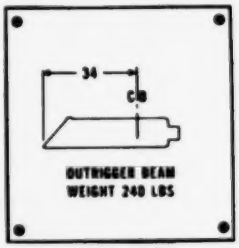


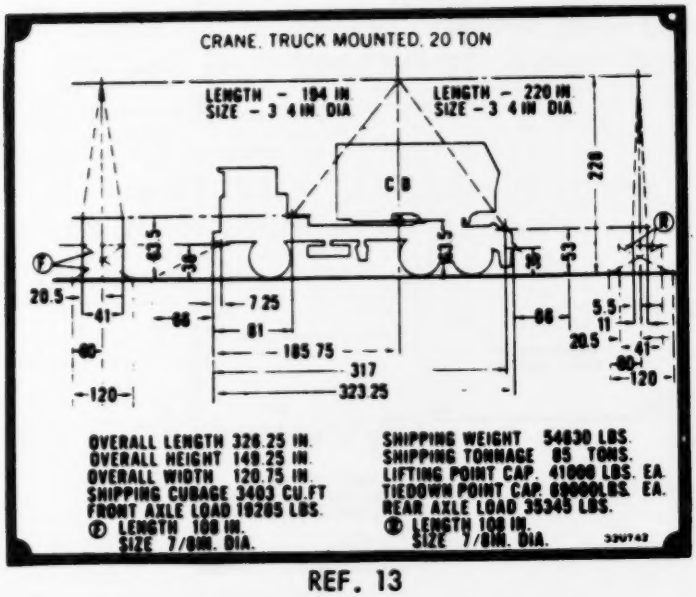
REF. 14


Caution
This equipment shall not be operated in a position where any part of the machine, suspended load or lines can be brought closer than 10 feet of power lines, unless the current has been shut off and the wires grounded.
NOTE WHEN PAINTING THIS EQUIPMENT KEEP THIS PLATE COVERED.
Caution

REF. 10

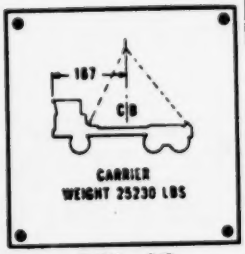


REF. 15

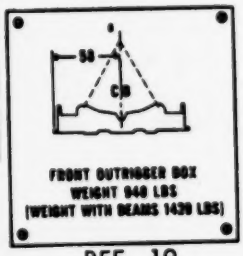


REF. 13

REF. 16



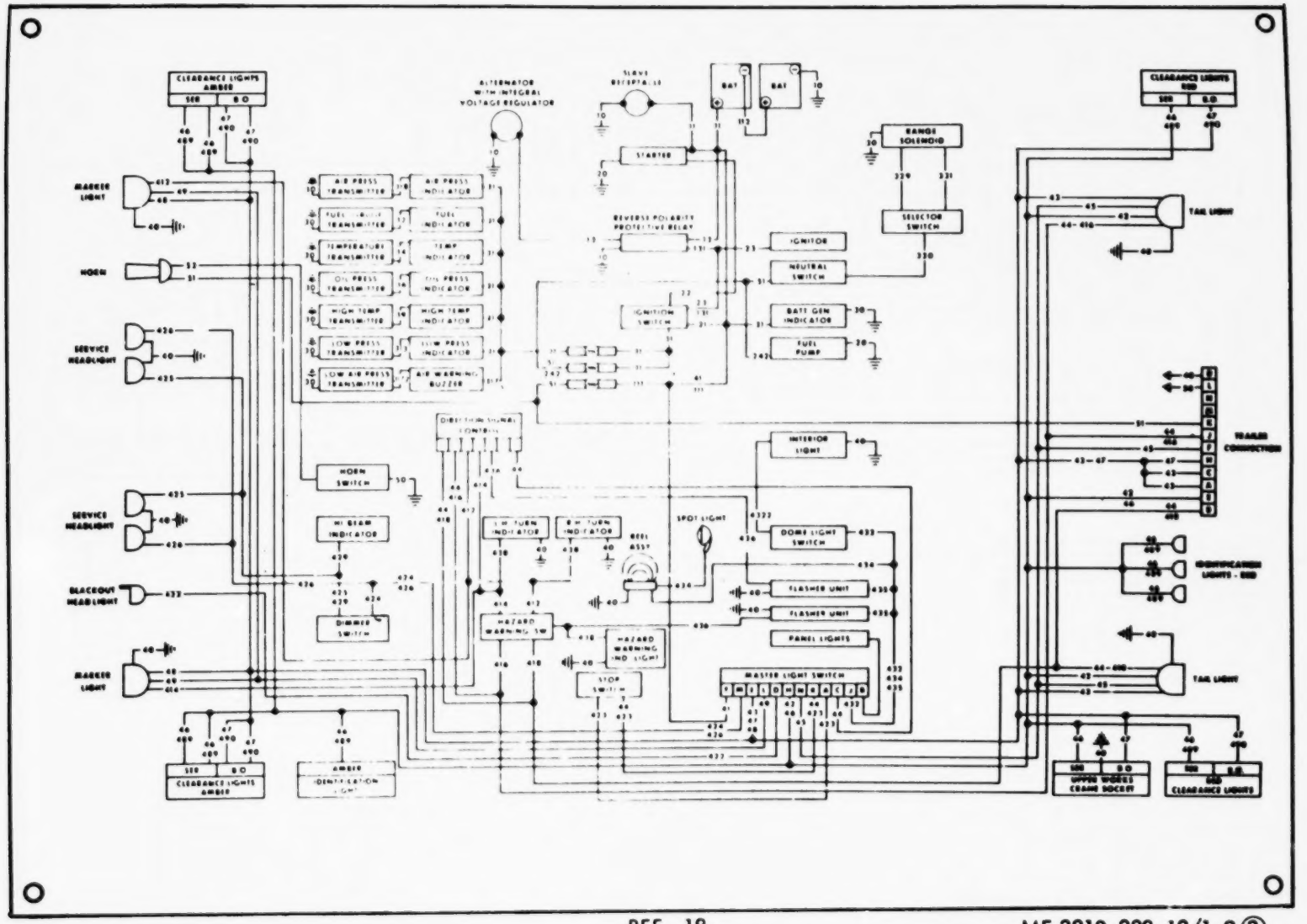
REF. 17



REF. 19

ME 3810-294-10/1-8 ②

Figure 1-8. Identification and instruction plates (sheet 2 of 4).



REF. 18

ME 3810-288-12/1-9 ③

Figure 1-8. Identification and instruction plates (sheet 3 of 4).

MODEL M 320 T-20 TON TRUCK CRANE—CLASS 10-79

RATED CRANE LOADS IN LBS. – MAIN BOOM

WITH OUTRIGGERS

OPER RAD FT	30 FT BOOM ANGLE	30 FT BOOM BOOM PT EL	30 FT BOOM RATING LBS	40 FT BOOM ANGLE	40 FT BOOM BOOM PT EL	40 FT BOOM RATING LBS	50 FT BOOM ANGLE	50 FT BOOM BOOM PT EL	50 FT BOOM RATING LBS	60 FT BOOM ANGLE	60 FT BOOM BOOM PT EL	60 FT BOOM RATING LBS	70 FT BOOM ANGLE	70 FT BOOM BOOM PT EL	70 FT BOOM RATING LBS	80 FT BOOM ANGLE	80 FT BOOM BOOM PT EL	80 FT BOOM RATING LBS	90 FT BOOM ANGLE	90 FT BOOM BOOM PT EL	90 FT BOOM RATING LBS	OPER RAD FT
10	78	37' 6"	40,000																			10
15	68	34' 0"	34,800	74	46' 6"	34,600	77	56' 11"	34,400													15
20	57	33' 4"	22,100	66	44' 9"	21,900	71	55' 5"	21,700	74	65' 11"	21,500	77	76' 4"	21,300							20
25	45	29' 3"	16,000	58	42' 0"	15,800	65	53' 5"	15,600	69	64' 4"	15,400	72	74' 11"	15,100	75	85' 4"	14,900	76	95' 8"	14,700	25
30	29	22' 4"	12,400	49	38' 3"	12,200	58	50' 9"	12,000	64	62' 2"	11,800	68	73' 0"	11,500	71	83' 9"	11,300	73	94' 4"	11,100	30
35				39	32' 11"	9,850	51	47' 2"	9,600	59	59' 4"	9,400	64	70' 10"	9,150	67	81' 10"	8,900	70	92' 8"	8,650	35
40				25	24' 8"	8,150	44	42' 5"	7,900	53	55' 11"	7,700	59	68' 0"	7,450	63	79' 6"	7,200	66	90' 6"	6,950	40
45							36	36' 2"	6,650	47	51' 8"	6,450	54	64' 8"	6,150	59	76' 9"	5,950	63	88' 2"	5,700	45
50							22	26' 9"	5,700	40	46' 2"	5,450	49	60' 8"	5,200	55	73' 5"	4,950	59	85' 4"	4,700	50
55										31	39' 0"	4,700	43	55' 8"	4,400	50	69' 6"	4,200	55	82' 2"	3,950	55
60										20	28' 6"	4,050	37	49' 8"	3,800	45	64' 11"	3,550	51	78' 4"	3,300	60
70													19	30' 3"	2,850	34	52' 9"	2,600	43	68' 11"	2,300	70
80																18	31' 10"	1,900	32	55' 8"	1,600	80

WITHOUT OUTRIGGERS

OPER RAD FT	30 FT BOOM OVER SIDE	30 FT BOOM OVER REAR	40 FT BOOM OVER SIDE	40 FT BOOM OVER REAR	50 FT BOOM OVER SIDE	50 FT BOOM OVER REAR	60 FT BOOM OVER SIDE	60 FT BOOM OVER REAR	70 FT BOOM OVER SIDE	70 FT BOOM OVER REAR	80 FT BOOM OVER SIDE	80 FT BOOM OVER REAR	90 FT BOOM OVER SIDE	90 FT BOOM OVER REAR	OPER RAD FT
10	28 900	27 300													10
15	16 300	17 200	16 100	16 900	15 800	16 600									15
20	11 100	12 100	10 800	12 000	10 600	11 700	10 800	11 500	10 300	11 200					20
25	8 200	9 450	7 950	9 200	7 700	8 900	7 450	8 650	7 200	8 350	[illegible]	[illegible]	[illegible]	[illegible]	25
30	6 400	7 600	6 200	7 350	5 900	7 050	5 650	6 800	5 400	6 550	5 [illegible]	6 250	4 850	5 950	30
35			4 950	6 000	4 700	5 750	4 450	5 450	4 150	5 [illegible]	[illegible]	4 [illegible]	[illegible]	4 [illegible]	35
40			4 150	5 050	3 900	4 750	3 650	4 500	3 350	4 200	3 [illegible]	3 [illegible]	2 [illegible]	[illegible]	40
45					3 100	4 000	2 850	3 750	2 550	3 450	2 350	3 200	2 050	2 900	45
50					2 450	3 400	2 200	3 [illegible]	1 950	2 850	1 [illegible]	2 [illegible]	1 400	[illegible]	50
55							1 800	2 650	1 500	2 350	1 250	2 100	1 000	1 800	55
60							1 450	2 250	1 150	1 950	900	1 700	600	1 400	60

JIB LENGTH 15' 0". MAXIMUM ANGLE JIB LONGITUDINAL AXIS TO BOOM LONGITUDINAL AXIS IS 60°. MAXIMUM JIB LOAD NOT TO EXCEED 7500 LBS. JIB CRANE RATING AT ANY RADIUS FROM CENTER OF ROTATION IS THE SAME AS CRANE RATING SHOWN IN TABLE FOR MAIN BOOM WHEN OPERATED AT THAT RADIUS BUT NOT TO EXCEED MAXIMUM JIB RATING. FOR BUCKET RATINGS ON JIB DEDUCT 20% FROM JIB RATINGS. MAXIMUM JIB OPERATING RADIUS NOT TO EXCEED LENGTH OF MAIN BOOM ON WHICH IT IS BEING USED. USE OF OUTRIGGERS RECOMMENDED WHEN BOOM IS EQUIPPED WITH JIB.

OPERATING RADIUS IS HORIZONTAL DISTANCE FROM CENTERLINE OF ROTATION TO A VERTICAL LINE THROUGH THE GRAVITY CENTER OF LOAD. GROSS CRANE RATINGS SHOWN ARE FOR UNITS WITH 5300 LBS. CAST COUNTERWEIGHT MOUNTED ON P&H CRANE CARRIER AND DO NOT EXCEED 85% OF TIPPING LOADS. RATING AT 10 FT. RADIUS WITH OUTRIGGERS IS BASED ON STRENGTH OF MATERIALS.

THE CRANE RATINGS INCLUDE WEIGHT OF HOOK, BLOCKS, SLINGS, AND ALL OTHER CRANE HANDLING ACCESSORIES. RATINGS WITH OUTRIGGERS ARE BASED ON OUTRIGGERS EXTENDED TO A FULCRUM POINT OF 6' 8½" FROM CENTER OF CARRIER. RATINGS WITHOUT OUTRIGGERS DEPEND UPON PROPER INFLATION, CAPACITY, AND CONDITION OF TIRES.

RATED LOADS – MAIN BOOM – LBS

OPER RAD FT	CLAMSHELL 30 FT BOOM	CLAMSHELL 40 FT BOOM	DRAGLINE 30 FT BOOM	DRAGLINE 40 FT BOOM
20	7500			
25	6500	6300	6500	
30		5000	5700	5600
35				4500

CLAMSHELL RATINGS SHOWN ALSO APPLY TO MAGNET GRAPPLE AND ALL OTHER MATERIAL HANDLING BUCKETS EXCEPT DRAGLINE WHICH IS RATED SEPARATELY FOR CLAMSHELL, DRAGLINE AND MAGNET OPERATIONS. THE WEIGHT OF BUCKET OR MAGNET IS CONSIDERED A PART OF THE LOAD AND THE TOTAL WEIGHT OF BUCKET PLUS CONTENTS OR MAGNET PLUS LOAD MUST NOT EXCEED THE CORRESPONDING RATINGS SHOWN. MAXIMUM ALLOWABLE SIZE OF DRAGLINE OR CLAMSHELL BUCKET 3/4 CUBIC YARDS.

NUMBER OF PARTS OF MAIN HOIST REEVING	1	2	3	4	5
MAXIMUM LOAD LBS	10,000	20,000	30,000	40,000	40,000

BACKSTOPS RECOMMENDED FOR ALL BOOM LENGTHS, AT RADII AND BOOM LENGTHS WHERE NO RATINGS ARE SHOWN ON PLATE. OPERATION IS NOT INTENDED OR APPROVED. RATINGS ARE BASED UPON FREELY SUSPENDED LOADS AND MACHINE STANDING ON FIRM, LEVEL, UNIFORMLY SUPPORTING SURFACE. SAFE LOADS DEPEND UPON GROUND CONDITIONS, BOOM LENGTH, RADIUS OF OPERATION, AND PROPER HANDLING, ALL OF WHICH MUST BE TAKEN INTO ACCOUNT BY THE USER. RATINGS ARE CONTINGENT UPON MACHINE BEING EQUIPPED WITH PROPER BOOM.

NOTE OPERATION OF THIS EQUIPMENT IN EXCESS OF RATED LOADS AND DISREGARD OF INSTRUCTIONS VOIDS THE WARRANTY.

REF. 20

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Figure 1-8. Identification and instruction plates (sheet 4 of 41).

b. Tabulated Data.

(1) *Truck crane.*

Manufacturer	Harnischfeger Corporation
Model	M320T2

(2) *Dimensions and transportation data (fig. 1-8).*

Overall length, with boom in travel position	536 inches
Overall length, without boom	326.25 inches
Overall width	119 inches
Overall height, at gantry sheave shaft	149.25 inches
Shipping cubage	3,354 cubic feet
Shipping tonnage	85 tons

(3) *Approximate weights.*

Truck crane with counterweight boom	59,860 pounds
Truck crane with counterweight and without boom	55,380 pounds
Carrier	29,640 pounds
Crane with counterweight	25,740 pounds
Crane without counterweight	20,360 pounds
Boom tip section with two guy lines attached	1,460 pounds
Boom insert, 10 foot	500 pounds
Guy lines, 10 foot, set of two	100 pounds
Boom base section	1,020 pounds
Upper spreader	220 pounds
Hook block	480 pounds
Boom backstops with pins	1,000 pounds
Fairlead	732 pounds

(4) *Speeds (full throttle and full load).*

Rear drum shaft	48.4 rpm
Rear drum shaft lowering	Gravity
Front drum shaft raising	48.4 rpm
Front drum shaft lowering	26.175 rpm
Front drum line speed, lowering	92.4 feet per minute
Boom hoist drum shaft	96.8 rpm
Boom hoist drum shaft, lowering	45.8 rpm
Boom hoist drum line speed, lowering	112.5 feet per minute
Revolving frame rotation	4.06 rpm

(5) *Rated capacities.*

Crane	20 tons (see rating plat fig. 1-8)
Clamshell	¾ cubic yard
Dragline	¾ cubic yard
Backhoe	¾ cubic yard
Shovel	¾ cubic yard
Rear drum line pull, sea level	15,900 pounds
Rear drum line pull, 5000 feet altitude	12,550 pounds
Front drum line pull, sea level	15,400 pounds
Front drum line pull, 5000 feet altitude	12,200 pounds
Boom hoist drum line pull	7,000 pounds

(6) *Fuel, water, oil and grease capacities, carrier.*

Engine fuel tank	75 gallons
Cooling system	40 quarts
Crankcase	12 quarts
Transmission	8 quarts
Drop box	4 quarts
Transfer case	8½ pints
Front axle	11 quarts
Front rear axle	11½ quarts
Rear rear axle	11 quarts
Steering gear and tank	7 pints

(7) *Fuel, water, and oil capacities, Crane.*

Engine fuel tank	50 gallons
Cooling system	35 quarts
Crankcase	9 quarts
Transmission	9 pints
Gear and chain case	18 gallons
Hydraulic system reservoir	3 quarts

(8) *Crane lifting capacities.* See figure 1-8 for crane lifting capacities.

(9) *Crane working ranges.* See figure 1-9 for crane working ranges.

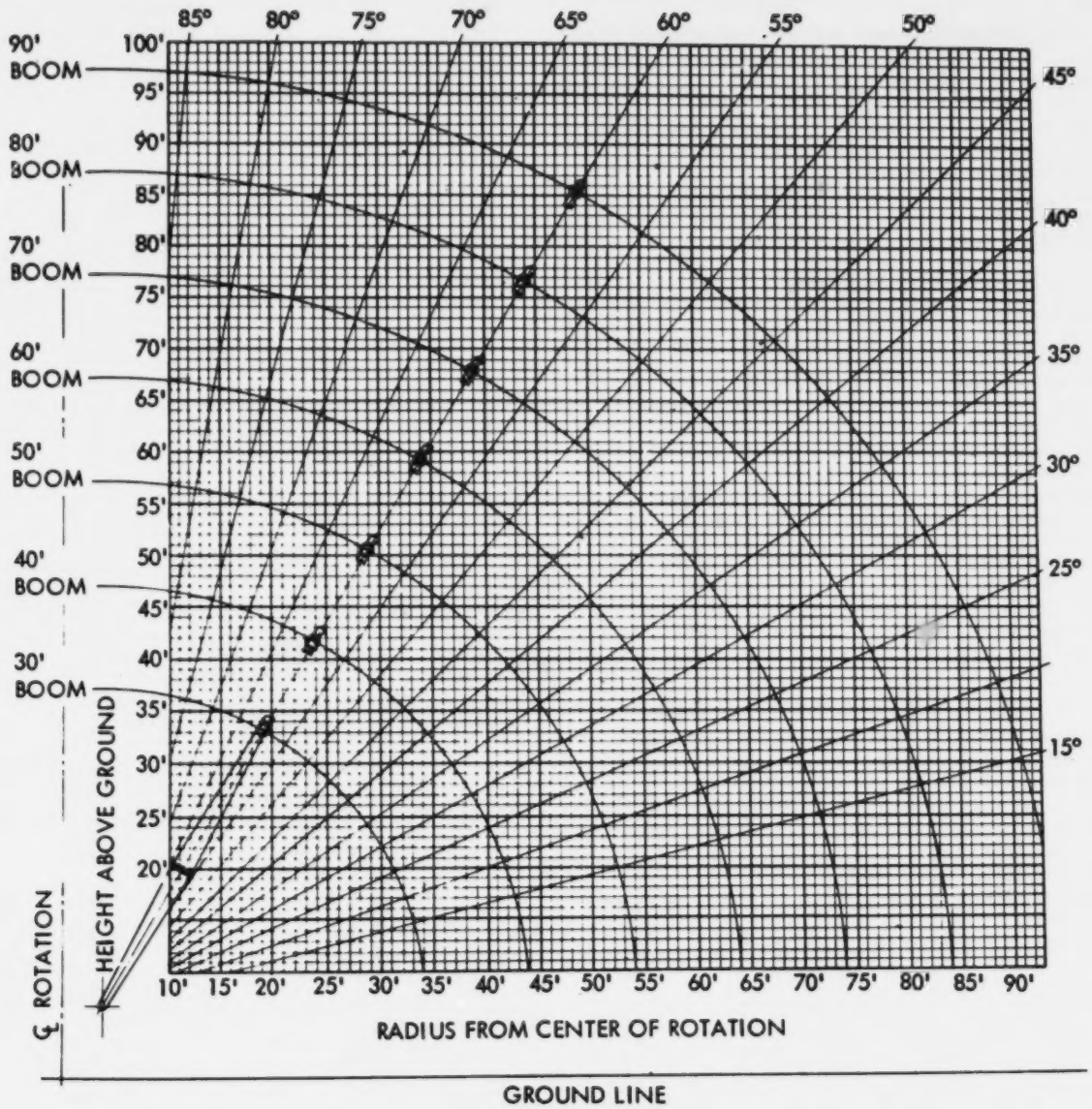

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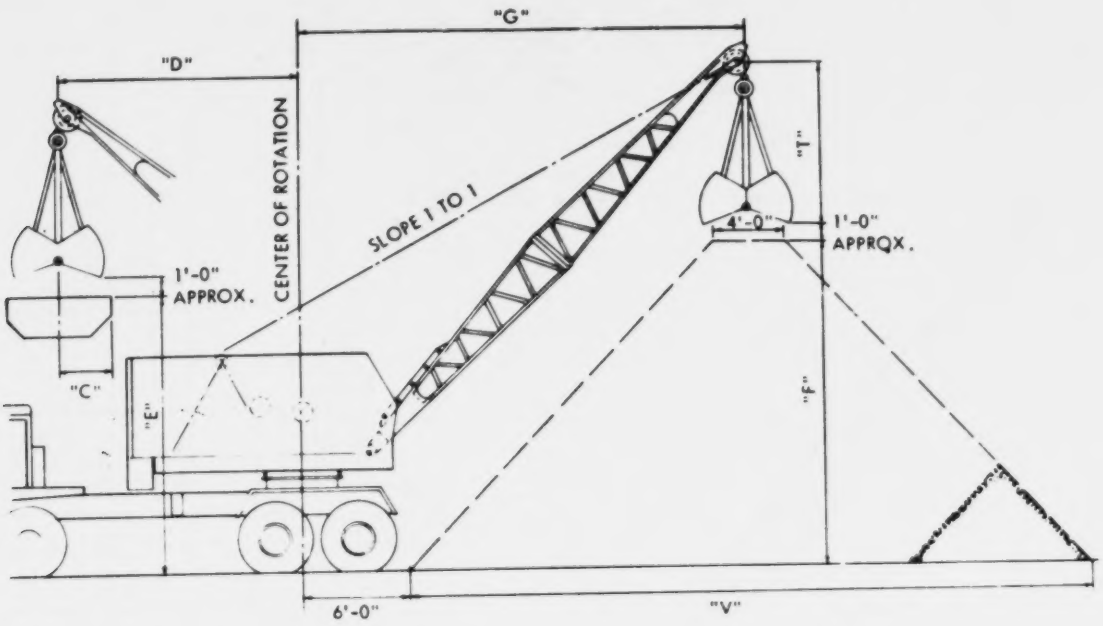
Figure 1-9. Crane range diagram.

(10) ***Clamshell working ranges.*** **See figure 1-10 for clamshell working ranges.**



CLAMSHELL WORKING RANG				
OPERATING RADIUS "D" IN FEET	30 FT. BOOM		40 FT. BOOM	
	HEIGHT & 1/2 WIDTH OF BIN		HEIGHT & 1/2 WIDTH OF BIN	
	"E"	"U"	"E"	"U"
15	24'-6"	3'-4"	31'-8"	3'-8"
20	21'-10"	5'-9"	29'-6"	5'-7"
25	17'-11"	9'-4"	26'-1"	8'-1"
30				
HEIGHT AND WIDTH OF STOCK PILE	"F"	"V"	"F"	"V"
	17'-4"	39'-0"	24'-5"	53'-0"
OPERATING RADIUS "G"	25'-6"		32'-6"	
"T" (3/4 CU. YD. BUCKET)	9'-9"			

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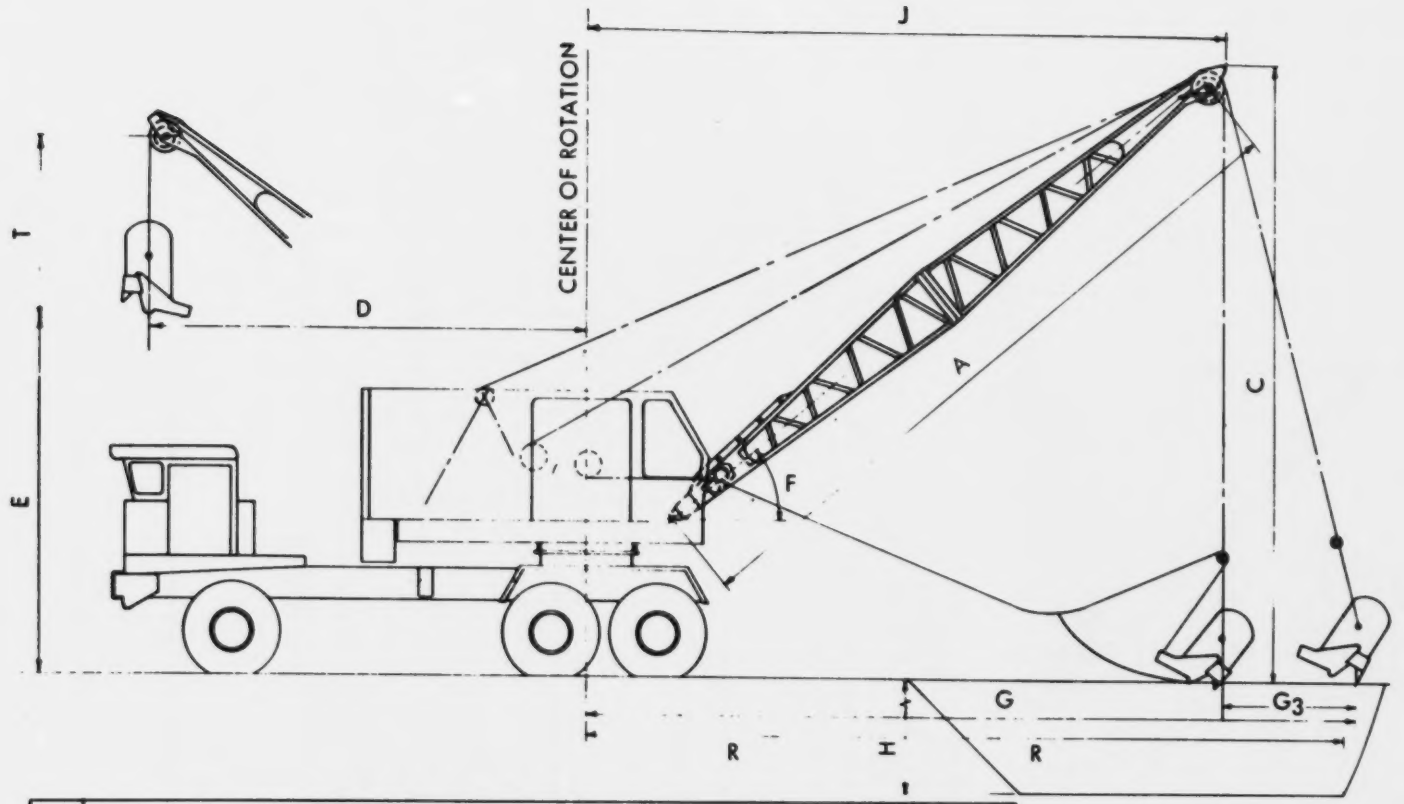
Figure 1-10. Clamshell range diagram.

(11) *Dragline working ranges.* See figure 1-11 for dragline working ranges.



	DRAGLINE WORKING RANGE				
A	BOOM LENGTH	30 FT.		40 FT.	
F	BOOM ANGLE	25	40	25	40
D	DUMPING RADIUS	31'-9"	27'-6"	40'-9"	35'-1"
E	DUMPING HEIGHT (MAX.)	9'-3"	15'-10"	13'-6"	22'-3"
G	DIGGING REACH (APPROX.)	38'-9"	36'-9"	49'-2"	46'-5"
G_3	CASTING DISTANCE (APPROX.)	7'-0"	9'-3"	8'-5"	11'-4"
H	MAX. DIGGING DEPTH	17'-2"	14'-11"	23'-6"	23'-4"
C	CLEARANCE HEIGHT OF BOOM POINT	21'-0"	27'-9"	25'-3"	34'-1"
J	CLEARANCE RADIUS OF BOOM POINT	32'-6"	28'-2"	41'-7"	35'-10"
R	MAX. REACH = MAX. DIGGING DEPTH	38'-9"	36'-9"	45'-1"	45'-3"
T	HEIGHT OF DRAGLINE BUCKET - 3/4 CU. YD.	10'-9"	10'-9"	10'-9"	10'-9"

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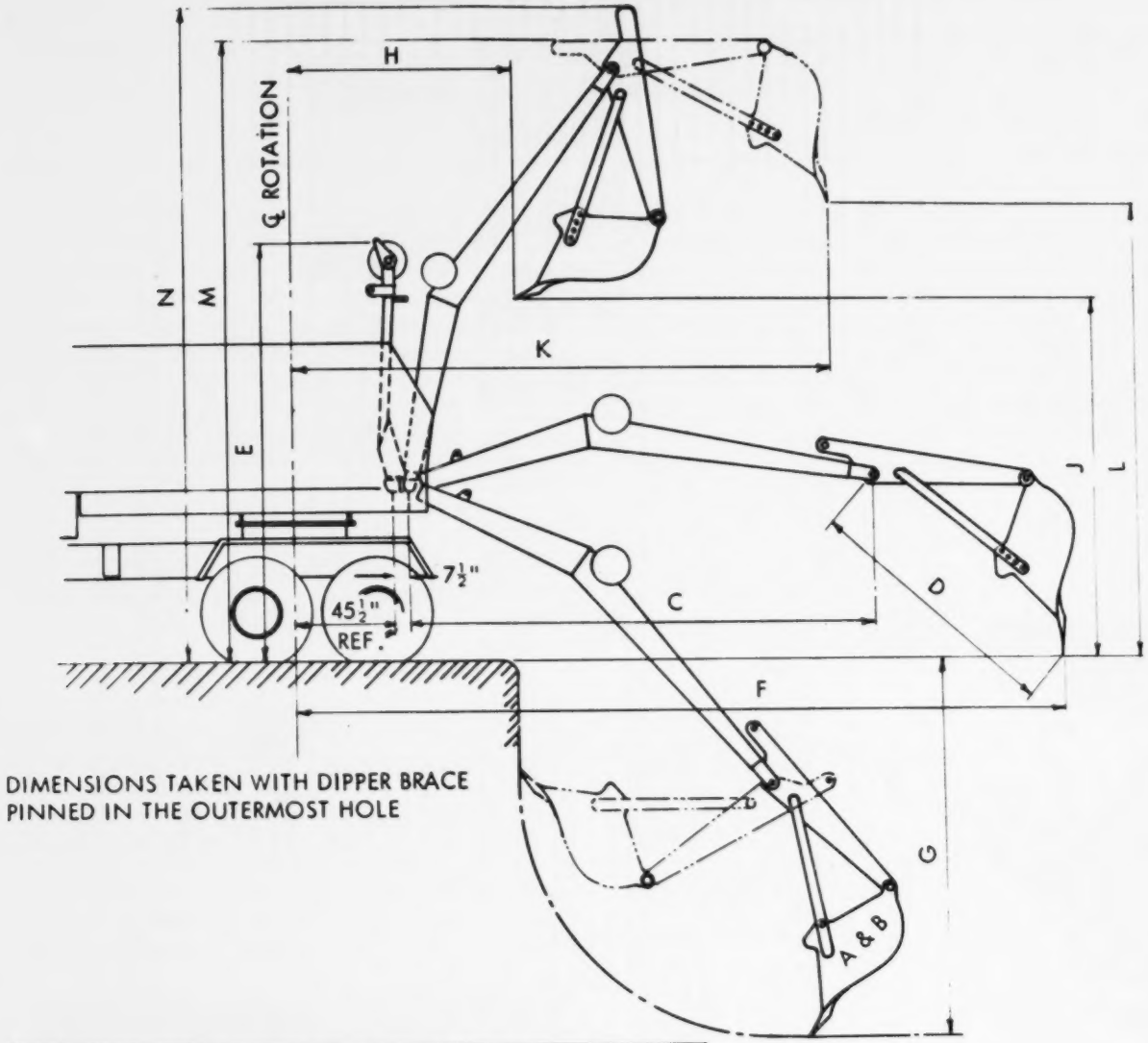
Figure 1-11. Dragline range diagram.

(12) ***Backhoe working ranges.*** **See figure 1-12 for backhoe working ranges.**



	TRENCH HOE WORKING RANGE	
A	HOE DIPPER CAPACITY - CUBIC YARDS	3/4
B	HOE DIPPER WIDTH (OVER SIDE CUTTERS)	3'-3"
C	BOOM LENGTH	18'-0"
D	SWEEP RADIUS	10'-10"
E	HEIGHT OF HOE GANTRY	16'-5"
F	DIGGING REACH (AT GRADE LEVEL - MAX)	28'-10"
G	DIGGING DEPTH (MAXIMUM)	14'-6"
H	RADIUS AT BEGINNING OF DUMP	9'-5"
J	DUMPING HEIGHT AT BEGINNING OF DUMP	12'-10"
K	RADIUS AT END OF DUMP	20'-0"
L	DUMPING HEIGHT AT END OF DUMP	15'-6"
M	OVERALL HEIGHT AT END OF DUMP	24'-6"
N	OVERALL HEIGHT AT BEGINNING OF DUMP	25'-2"

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Figure 1-12. Backhoe range diagram.

(13) *Cable specifications.* Refer to table 1-1 for cable lengths for each of the front-end attachments.

(14) *Bridge weight classification.* The bridge weight classification is E-29.

Table 1-1. Cable Specifications

	BOOM LENGTH	CABLE TYPE	CABLE DIA. (In.)	CABLE LENGTH SHOVEL	TRENCH HOE	DRAG LINE	CLAM SHELL	PILE DRIVER	CRANE 1 PART	CRANE 2 PART	CRANE 3 PART	CRANE 4 PART			
BOOM HOIST	18'-6"	†	1/2	245'-0" (Crane 10 Part, Shovel 8 Part & Hoe 4 Part)											
	19'-0"	†	1/2												
	30'-90"	†	1/2												
HOIST #	18'-6"	†	3/4		95'-0"										
	30'-0"	†	5/8						100'-0"	150'-0"	200'-0"	250'-0"			
	40'-0"	†	5/8						120'-0"	180'-0"	240'-0"	300'-0"			
	50'-0"	†	5/8						140'-0"	210'-0"	280'-0"	350'-0"			
	60'-0"	†	5/8						160'-0"	240'-0"	320'-0"	400'-0"			
	70'-0"	†	5/8						180'-0"	270'-0"	360'-0"	450'-0"			
	80'-0"	†	5/8						200'-0"	300'-0"	400'-0"				
	90'-0"	†	5/8						220'-0"	330'-0"	440'-0"				
	30'-0"	†	5/8			70'-0"									
	40'-0"	†	5/8			90'-0"									
DIGGING	18'-6"	†	3/4		65'-0"										
	30'-0"	†	3/4			57'-6"									
	40'-0"	†	3/4			57'-6"									
CLOSING #	30'-0"	†	5/8				85'-0"								
	40'-0"	†	5/8				105'-0"								
HOLDING #	30'-0"	†	5/8				70'-0"								
	40'-0"	†	5/8				90'-0"								
TAGLINE	30'-0"	†	3/8				60'-0"		15' JIB		20' JIB		25' JIB		30' JIB
	40'-0"	†	3/8				60'-0"		1 PART	2 PART	1 PART	2 PART	1 PART	2 PART	1 PART	2 PART
JIB HOIST #	30'-0"	†	5/8						110'-0"	160'-0"	120'-0"	175'-0"	130'-0"	190'-0"	140'-0"	205'-0"
	40'-0"	†	5/8						130'-0"	190'-0"	140'-0"	205'-0"	150'-0"	220'-0"	160'-0"	235'-0"
	50'-0"	†	5/8						150'-0"	220'-0"	160'-0"	235'-0"	270'-0"	250'-0"	180'-0"	265'-0"
	60'-0"	†	5/8						170'-0"	250'-0"	180'-0"	265'-0"	190'-0"	280'-0"	200'-0"	295'-0"
	70'-0"	†	5/8						190'-0"	280'-0"	200'-0"	295'-0"	210'-0"	310'-0"	220'-0"	325'-0"
	80'-0"	†	5/8						210'-0"	310'-0"	220'-0"	325'-0"	230'-0"	340'-0"	240'-0"	355'-0"
	90'-0"	†	5/8						230'-0"	340'-0"	240'-0"	355'-0"	250'-0"	370'-0"	260'-0"	385'-0"
GUY LINE JIB TO STRUT									35'-0"		45'-0"		55'-0"		65'-0"	
GUY LINE STRUT TO MAIN BOOM	30'-0"								68'-0"		68'-0"		68'-0"		68'-0"	
	40'-0"								88'-0"		88'-0"		88'-0"		88'-0"	
	50'-0"								108'-0"		108'-0"		108'-0"		108'-0"	
	60'-0"								128'-0"		128'-0"		128'-0"		128'-0"	
	70'-0"								148'-0"		148'-0"		148'-0"		148'-0"	
	80'-0"								168'-0"		168'-0"		168'-0"		168'-0"	
	90'-0"								188'-0"		188'-0"		188'-0"		188'-0"	
HAMMER HOIST #	30'-0"		5/8					75'-0"								
	40'-0"		5/8					95'-0"								
PILE HOIST #	30'-0"		5/8					90'-0"								
	40'-0"		5/8					110'-0"								
SHOVEL HOIST	19'-0"	†	5/8	105'-0"												
SHOVEL CROWD	19'-0"	†	3/4	57'-6"												
SHOVEL RETRACT	19'-0"	†	3/4	26'-0"												

NOTE:

1. † MIL SPEC RR-W-410, TYPE 1, CLASS 2, 6 x 19, CONSTRUCTION 3, IWRC, IPS, UNCOATED, PREFORMED, RIGHT REGULAR LAY

2. # HOIST LENGTHS PER MIL-C-10466D PAR. 3.17.33.2

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. OPERATING PROCEDURES

2-1. Inspecting and Servicing the Equipment

a. General. The operator / crew personnel of the carrier and crane may assist in unloading the equipment. The crew will help in the removal of the tie-down cables, strapping and blocking which secures the equipment. The operator will drive the carrier down the ramp when hoisting equipment is not available. See paragraph 5-2.

b. Inspecting and Servicing Procedures.

(1) Make certain that the engine cooling systems are full. See TB 750-651 for proper antifreeze solutions.

(2) Fill the crane and carrier fuel tanks with gasoline.

(3) Make certain that the hydraulic system reservoirs on the crane and carrier are filled with hydraulic fluid to the proper level.

(4) Check the tires for normal operating pressure (75 psi).

(5) The crane anti-rotation device consists of two rods which are permanently fixed to the carrier frame and secured to the frame by a clamp when not in use. When in use, they are screwed to two threaded rods on the bottom of the crane revolving frame, forming an "X" pattern. In this condition, they prevent the upper from turning in relation to the carrier. Unscrew the anti-rotation devices where they are attached to the revolving frame and store them as shown in figure 2-1.

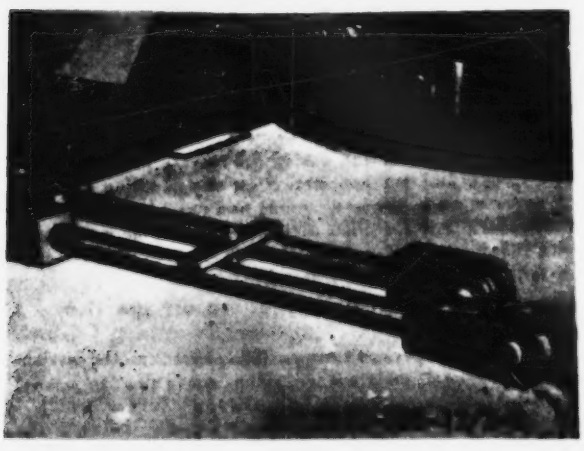


Figure 2-1. Anti-rotation device, stored position.

2-2. Installation or Setting Up Instructions

a. General. Set up the equipment in a location where the carrier will be level. Uneven terrain may have to be leveled. Outriggers are provided to improve machine stability; the outriggers must be extended and set as specified on the rating plate in the crane operator's cab. When using the outriggers, the jackscrews must be kept tight against the jackfloats at all times during operation.

b. Extending the Outriggers. Refer to figure 2-2 and extend the outrigger as follows:

(1) Remove lockpin.

(2) Pull outrigger beam out.

(3) Install jackfloats as shown and secure with U-clamp.

Figure 2-2. Extending Outriggers.

c. Setting the Outriggers.

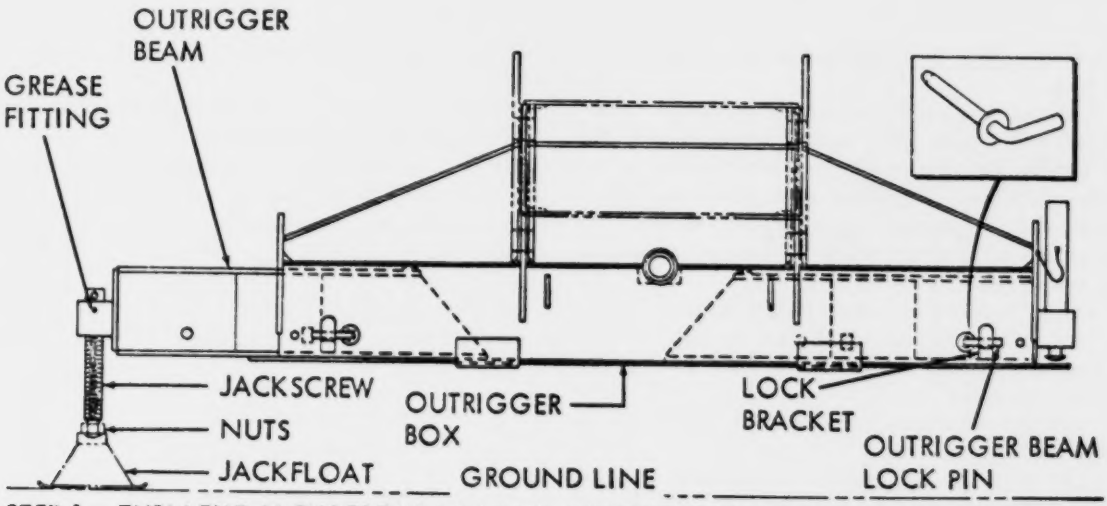
(1) Swing the crane so that the counterweight is over the left side of the carrier, to relieve pressure on the jackfloats on the right side of the carrier. Refer to paragraph 2-10b(1). Turn down the jackscrews on the right side of the carrier until the jackfloats on the right side are firmly supporting the machine.

(2) Swing the crane so that the counterweight is over the right side of the carrier, to relieve pressure on the jackfloats on the left side of the

carrier. Turn down the jackscrews on the left side of the carrier until the jackfloats on the left side are firmly supporting the machine.

(3) Position the outriggers so that they are down far enough to take strain off the tires and machine is level within one degree.

d. Retracting the Outriggers. Refer to figure 2-3 and retract the outriggers.



STEP 1. TURN THE JACKSCREWS UP UNTIL WEIGHT OF MACHINE IS SUPPORTED ON CARRIER TIRES. REFER TO FIGURE 2-2.

STEP 2. REMOVE THE U-CLAMP PINS, AND REMOVE THE JACKFLOATS FROM THE JACKSCREWS. STORE THE JACKFLOATS WITH THE U-CLAMP PINS IN THE WELLS OF THE CARRIER DECK.

STEP 3. REMOVE THE LOCK PINS FROM THE OUTRIGGER BOXES.

STEP 4. PUSH THE OUTRIGGER BEAMS BACK INTO THE OUTRIGGER BOXES, AND RE-PIN THE BEAMS BACK INTO THE RETRACT D POSITION.

CAUTION: THE OUTRIGGERS MUST BE PINNED IN THE RETRACTED POSITION WHEN TRAVELING THE CARRIER.

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Figure 2-3. Retracting the outriggers.

2-3. Equipment Conversion

The basic truck crane can be converted to various uses by changing front-end attachments. The converted truck crane may be referred to as a crane, clamshell, dragline, piledriver, backhoe, or shovel. The various conversions are described in paragraphs 2-4 through 2-9. When a conversion is anticipated, make certain that all required attachments, tools, blocking, a suitable lifting device and organizational maintenance personnel are available.

Note. Before reeving any line, lay out the line so that there is no possibility of kinking during the reeving process. Refer to paragraph 3-31 for information on the handling and maintenance of cable. When wrapping new cable on a drum, wrap the cable slowly and make certain that the cable wraps evenly on the drum the first time.

2-4. Crane Conversion

Note. It is the operator's responsibility to request the services of organizational maintenance when converting to crane operation. Organizational maintenance is specifically responsible for proper installation and removal of the crane boom, and will assist operators in proper installation of cables and other accessory items.

a. General. The truck crane may be converted to crane operation by installing the crane front-end assembly. The following components are necessary for the equipment conversion; one 15 foot boom base section, one 15 foot point section, boom foot pins, boom guy cables, boom hoist cable, boom backstops, hoist line, and hook block. The basic crane boom may be extended by installing boom inserts between the boom base section and the boom point section. The boom inserts are in 10-foot lengths, and must be for the specific boom installed so that the connecting joints of the boom and insert match. Longer guy cables are necessary when the length of the boom is increased. Refer to table 1-1.

b. Boom Installation.

Note. To install the boom, a cribbing will be necessary to support the boom in a horizontal position. The cribbing must be high enough to bring the boom into position with the boom foot lugs on the revolving frame, as shown in figure 2-4.

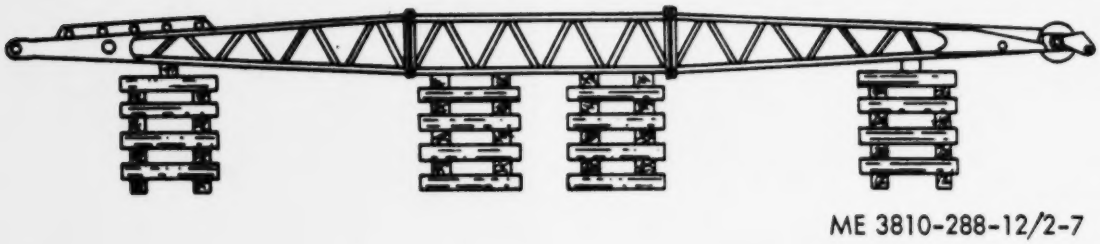

Figure 2-4. Cribbing prepared for boom assembly and installation.

(1) Lift the boom sections into place on the cribbing.

(2) Refer to figure 2-5 and install the boom connection capscrews, lockwashers and locknuts so that the boom base section, insert (if used), and tip section form a complete assembly.

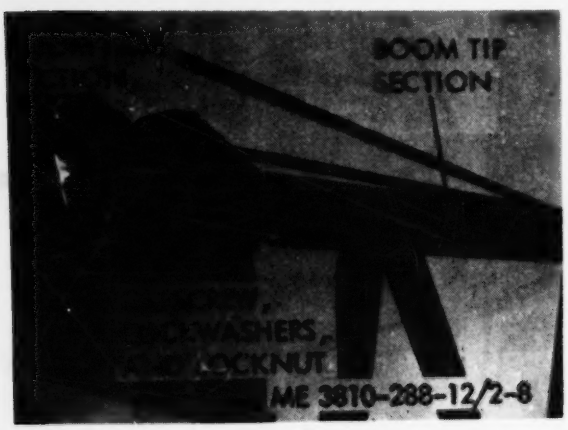

Figure 2-5. Connecting boom sections.

(3) Carefully move the carrier up to the cribbed up boom, so that the bores in the boom foot lugs on the revolving frame are alined with the bores in the boom base section.

(4) Refer to figure 2-6 and install the boom foot pins.

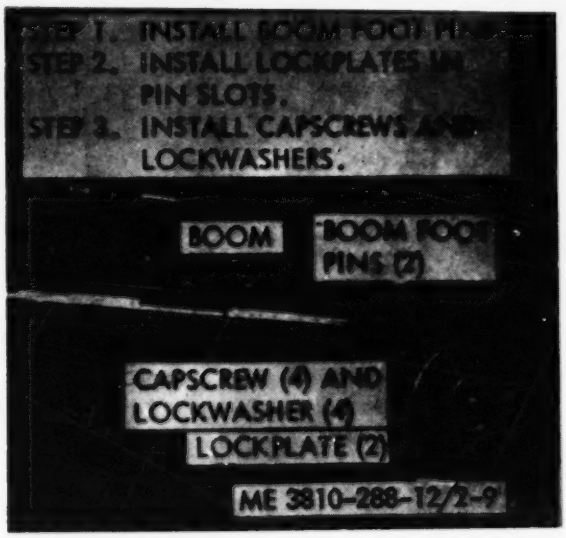

Figure 2-6. Installing boom foot pins.

(5) Install the boom backstops between the gantry and boom, as shown in figure 2-7.

Figure 2-7. Boom backstop installation. (sheet 1 of 2).

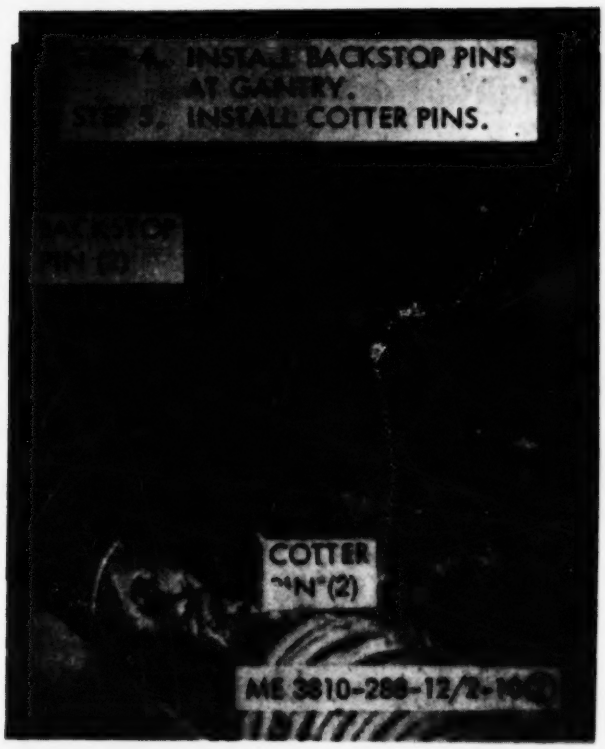

Figure 2-7. Boom backstop installation. (sheet 2 of 2).

c. Crane Boom Angle Indicator Installation. Refer to figure 2-8 and install the boom angle indicator.

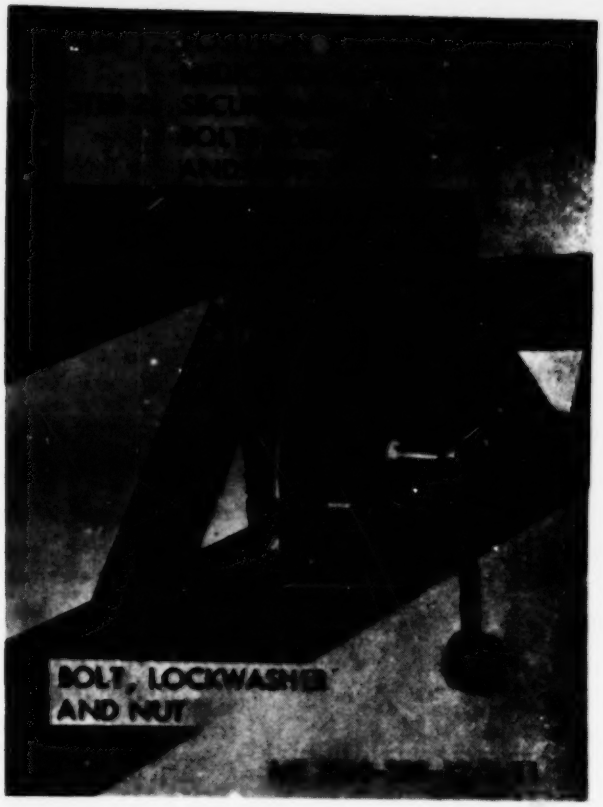

Figure 2-8. Crane boom angle indicator installation.

d. Boom Hoist Cable Reeving.

(1) Use a suitable lifting device, and lift the upper spreader into position on the boom. Install the two guy cables (fig. 2-9). Secure one end of each cable to the boom point and the other end to the upper spreader with pins. Secure the pins with cotter pins.

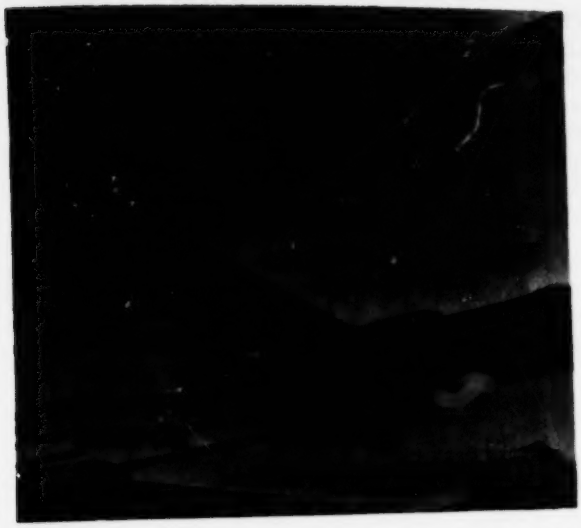

Figure 2-9. Guy cables, removal and installation (sheet 1 of 2).

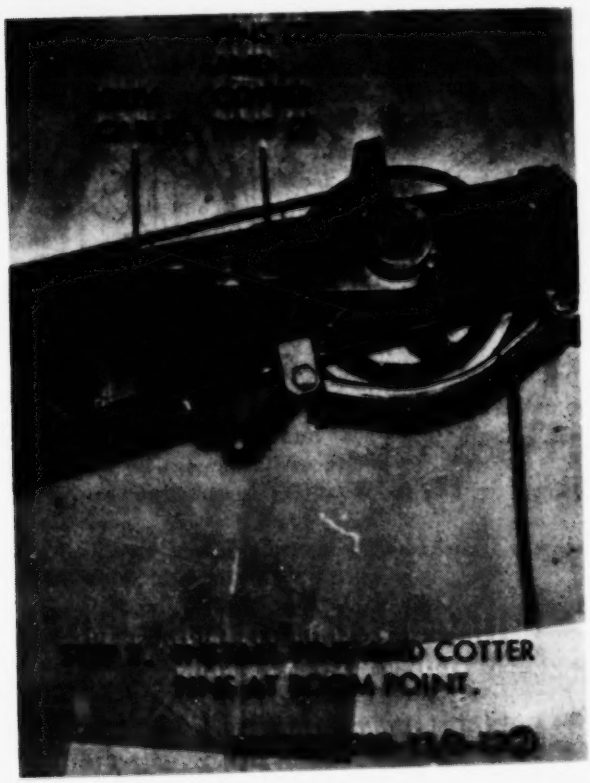

Figure 2-9. Guy cables, removal and installation (sheet 2 of 2).

(2) Install the gantry spreader on the gantry A-frame.

(3) Unroll and stretch the boom suspension cable out on the ground on the right side of the boom.

(4) Begin at the upper spreader center sheave as illustrated in figure 2-10 and reeve the left side of the upper spreader and lower spreader as shown. End at the dead end socket on the gantry A-frame.

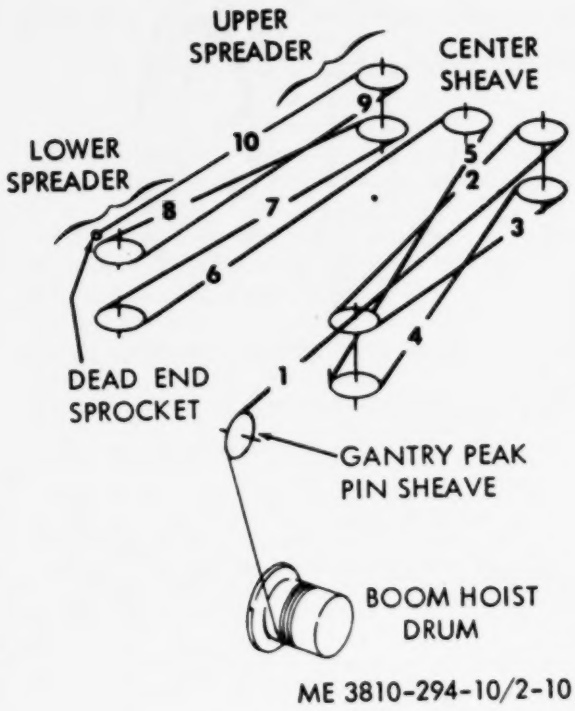

Figure 2-10. Boom hoist line reeving.

(5) Beginning at the upper spreader center sheave, reeve the right side of the upper spreader and lower spreader as shown in figure 2-10. End at the boom hoist drum.

(6) Secure the boom hoist line to the boom hoist drum as shown in figure 2-11 and spool the slack cable on the drum.

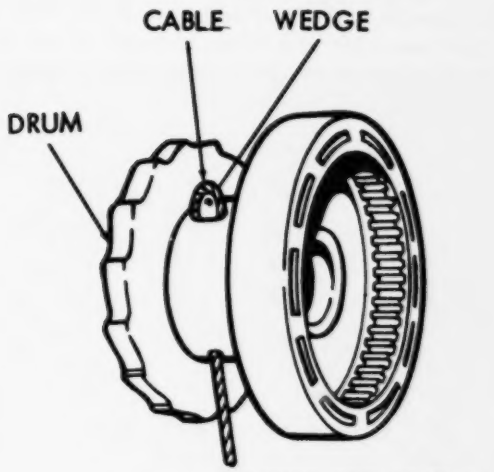

Figure 2-11. Securing cable to drum.

e. Main Hoist Line Reeving.

(1) Main hoist line reeving is shown in figure 2-12. The number of parts of line (from one to five) used on the main hoist line depends on the weight of the loads to be lifted and the line speed desired. For maximum speed of operation, use no more parts of line than are required for the loads to be lifted, within the limitations shown on the rating plate in the machine crane cab.

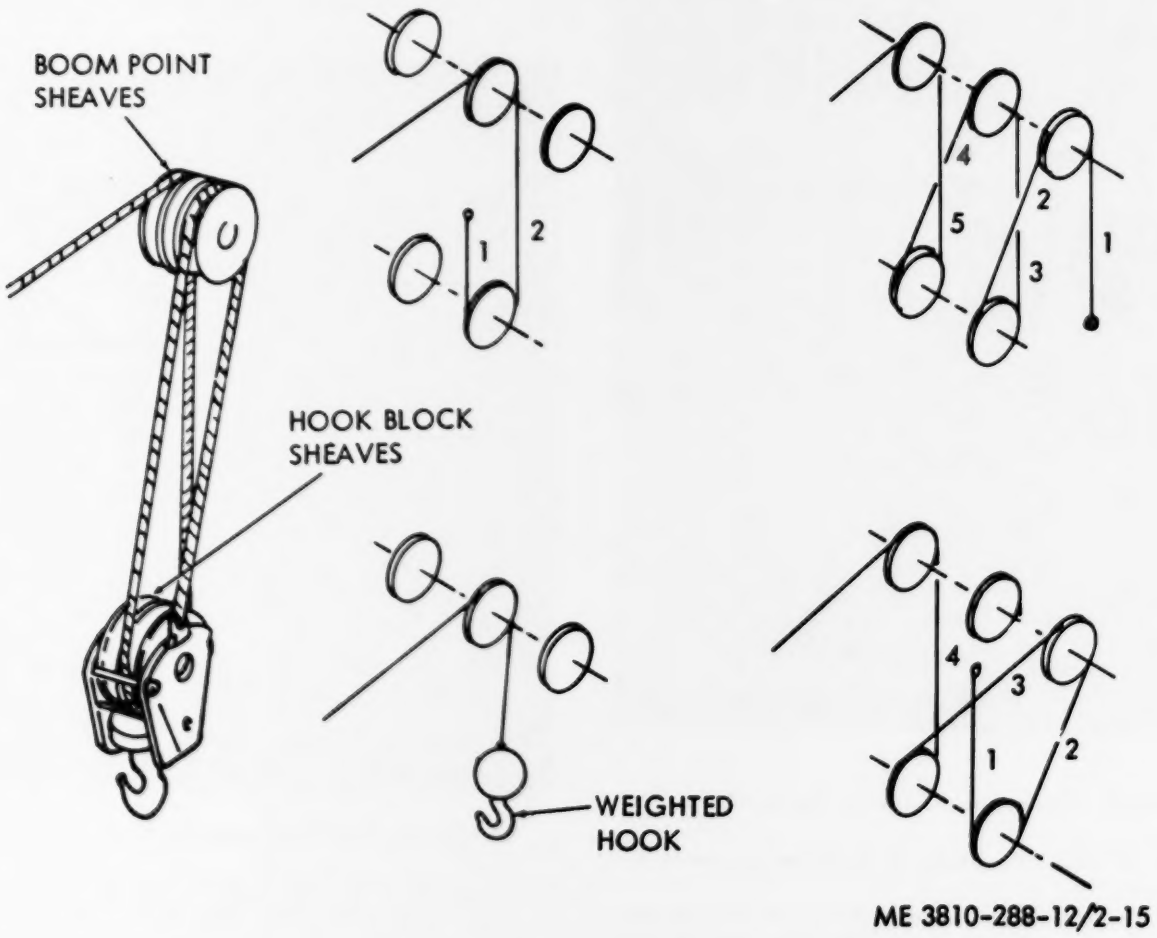

Figure 2-12. Main hoist line reeving.

(2) Reeve the main hoist line on the rear main drum, and reeve the secondary hoist line (if used) on the front main drum. If a jib is used, reeve the jib line on the rear main drum, and the main hoist line on the front main drum. Secure the hoist lines to the drums as shown in figure 2-11.

(3) A single-part line is reeved over the center boom point sheave, directly to a weighted hook, and is dead-ended at the hook. A weighted hook must be used for single line operation, instead of a hook block.

(4) A two-part line is reeved over the center boom point sheave, around one hook block sheave, and dead-ended at the boom point.

(5) A three-part line is reeved over the left boom point sheave, around a hook block sheave, around the right boom point sheave, and dead-ended at the hook block.

(6) A four-part line is reeved over the left boom point sheave, around the left hook block sheave, around the right boom point sheave, around the right hook block sheave, and dead-ended at the boom point.

(7) A five-part line is reeved over the left boom point sheave, around the left hook block sheave, around the center boom point sheave, around the right hook block sheave, around the right boom point sheave, and dead-ended at the hook block.

f. Unreeving the Hoist Line.

(1) Lower the hook block to the ground. Lower the boom until the boom point is approximately five feet from the ground.

(2) Remove the cable from the dead-end socket on the boom point or hook block.

(3) Unreeve the cable from the hook block and boom point sheaves.

(4) Release the drum brake, and pull the cable from the drum. Remove the cable wedge from the cable drum socket and free the cable.

(5) Pull the cable free of the cable drum and the boom point sheave, and lay it out straight on the ground.

(6) Roll the cable into a coil and secure it with wire. Label the cable for future use.

g. Unreeving the Boom Hoist Cable.

(1) Swing the revolving frame so that the boom is over the rear of the carrier. Lower the boom to a horizontal position, level with the carrier.

(2) Build up cribbing under the boom as shown in figure 2-4.

(3) Lower the boom to rest on the cribbing, and continue to slack off on the boom hoist cable until the upper spreader comes to rest on the boom.

(4) Unspool the boom hoist cable from the drum. Remove the wedge from the cable drum socket, and free the cable.

(5) Disconnect the cable dead-end at the gantry and free the cable. Refer to figure 2-10.

(6) Unreeve the boom hoist cable from the gantry spreader and upper spreader sheaves.

(7) Lay the cable out straight on the ground.

(8) Roll the cable into a coil and secure it with wire. Label the cable for future use.

(9) Remove the guy cables by removing the cotter pins and pins from both ends of the cables. Refer to figure 2-9.

(10) Using a suitable lifting device, lift the upper spreader from the crane boom.

h. Removing the Crane Boom.

(1) Unreeve the hoist line and boom hoist line. Support the boom on cribbing as shown in figure 2-4.

(2) Use wedges or a hydraulic jack to relieve the weight of the boom on the boom foot pins, and remove the pins. Refer to figure 2-6.

(3) Disconnect the boom backstops from the gantry A-frame and lay the backstops on the top of the boom. Refer to figure 2-7.

(4) Drive the carrier away from the boom.

2-5. Clamshell Conversion

Note. It is the operator's responsibility to request the services of organizational maintenance when converting to clamshell operation. Organizational maintenance is specifically responsible for proper installation and removal of the clamshell and boom, and will assist operators in proper installation of cables and other accessory items.

a. General. The truck crane may be converted to clamshell operation by installing the crane boom (para 2-4) and a clamshell bucket. The following components are necessary for the equipment conversion; the crane boom components (para 2-4), clamshell bucket, bucket holding and closing lines, tagline winder, and tagline. The crane hoist cable may be used for the bucket holding line, but if additional depth below ground level is desired, longer holding and closing lines must be installed. Refer to table 1-1.

b. Installation. Install the crane boom, backstops, and boom hoist cable as described in paragraph 2-4.

c. Reeving.

(1) Swing the crane boom over the clamshell bucket. Lower the boom to approximately six feet above the ground beside the clamshell bucket.

(2) Reeve the closing line on the clamshell, around the left boom point sheave, and to the rear hoist drum. Secure the line to the drum (fig. 2-11) and wrap sufficient line on the drum to close the clamshell bucket.

(3) Reeve the holding line around the right boom point sheave, and to the front hoist drum. Secure the line to the drum, and wrap line on the drum until the same number of turns are on both drums. Attach the holding line loosely to the clamshell bucket.

(4) Raise the boom to the working angle. Raise the clamshell bucket, using both lines, until the second layer begins on the rear (closing line) drum. The second layer should begin on the front drum at the same time. If it does not, adjust the point of attachment of the holding line to the bucket.

(5) Cut both lines and secure them to the bucket.

d. Tagline Winder.

(1) With a suitable lifting device, lift the tagline winder into position between the chords of the boom base section, near the upper end of the section.

STEP 1. UNREEVE TAGLINE (PARAGRAPH 2-5e).
STEP 2. REMOVE U-BOLT.
STEP 3. REMOVE MOUNTING BOLTS AND NUTS.

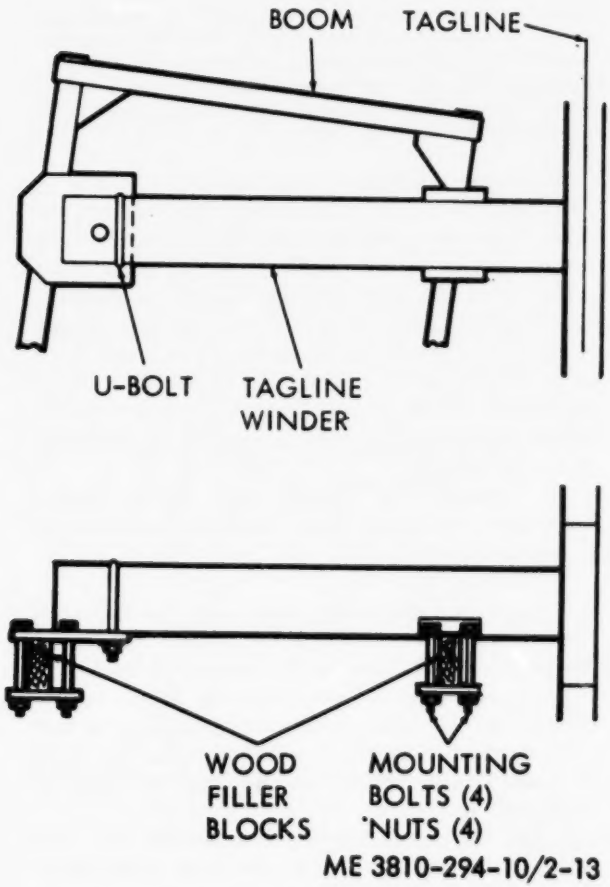

Figure 2-13. Tagline winder installation.

Note. Where there is no interference with machine operation, mount the tagline winder with the cable drum on the side away from the operator, to reduce interference with the operator's vision.

(2) Position the tagline winder at an angle on the boom so that the tagline drum is in line with the boom point, and so that the tagline will reel straight off the drum when the clamshell bucket is at half the height of the boom point (fig. 2-13).

(3) Secure the tagline winder to the boom, using wood filler blocks as necessary

Note. The tagline winder should be left on the boom when not in use.

e. Unreeving the Clamshell.

(1) Release the drum brakes and unspool the holding and closing cables from the front and rear drums.

(2) Remove the cable wedges from the dead-end sockets on the clamshell, and remove the closing and holding cables.

(3) Remove the cable wedges from both cable drums, and free the closing and holding cables.

(4) Pull the cables free of the drums and the boom point sheaves, and lay them out straight on the ground.

(5) Roll the cables into a coil and secure them with wire. Label the cables for future use.

(6) Remove the boom hoist cable and boom (para 2-4).

2-6. Dragline Conversion

a. General. The truck crane may be converted to dragline operation by installing the crane boom (para 2-4) and a dragline bucket. The following components are necessary for the equipment conversion; the crane boom components (para 2-4), drag bucket, bucket hoist and drag lines, and fairlead. The crane hoist cable may be used for the bucket hoist line, but if additional reach and depth are desired, a longer cable must be installed. Refer to table 1-1.

b. Installation and Reeving.

(1) Install the crane boom, backstops, and boom hoist cable as described in paragraph 2-4.

(2) Install the fairlead (fig. 2-14).

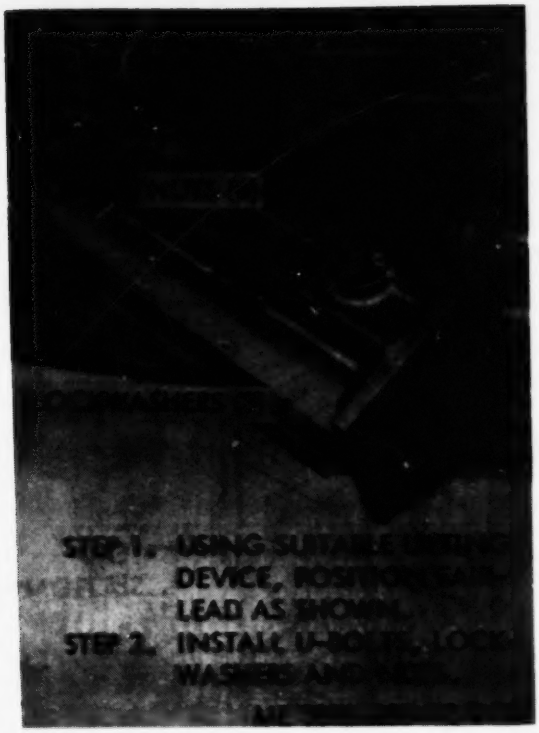

Figure 2-14. Fairlead, removal and replacement.

(3) Reeve the hoist cable over the center boom point sheave and secure it to the rear drum. Secure the remaining free end to the cable socket on the dump sheave chain (fig. 2-15).

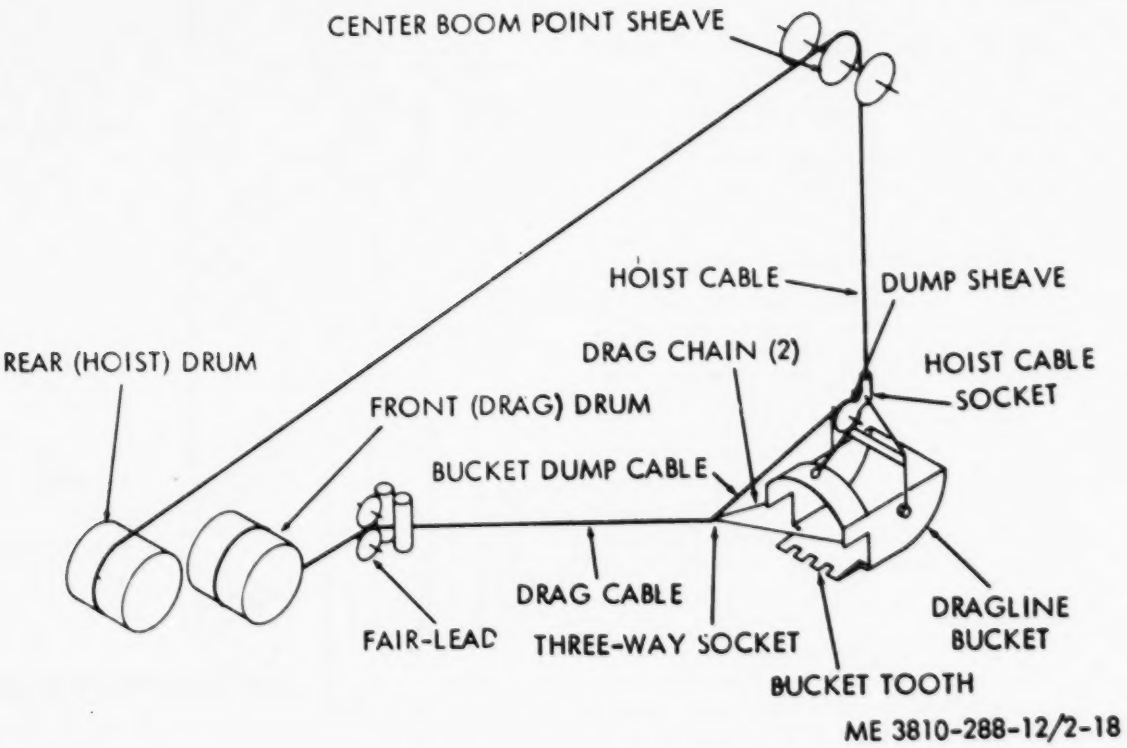

Figure 2-15. Dragline reeving diagram.

Note. When inserting the cable end back into the cable socket, do not let it protrude on the opposite side more th an one inch.

(4) Reeve the drag cable through the fairlead and secure it to the front drum. Reeve the remaining free end through the three-way socket and secure it.

(5) Insert one end of the bucket dump cable through the three-way socket and secure it with the cable wedge. Reeve the remaining free end over the dump sheave, down to the bucket arch, and dead-end the cable.

(6) The bucket teeth should be approximately 12 inches higher than the heel of the bucket when the bucket is suspended in midair and the drag cable is pulled tight. Remove the dump cable from the dead-end socket at the top of the bucket arch and lengthen or shorten it if necessary.

c. Removing and Unreeving.

(1) Lower the dragline bucket onto wood blocking.

(2) Remove the cable wedges from the three-way socket and the dead-end socket on the bucket arch. Unreeve the bucket dump cable from the dump sheave.

(3) Pull the hoist and drag cables free of the drag bucket, and unspool the cables from the front and rear drums.

(4) Remove the cable wedges from both drums, and free the hoist and draglines. Pull the cables free of the drums and the boom point sheaves.

(5) Lay the hoist, drag, and bucket dump cables straight on the ground. Roll the cables into coils and secure them with wire. Label the cables for future use.

(6) Remove the fairlead (fig. 2-14).

(7) Remove the boom hoist cable and boom (para 2-4).

2-7. Piledriver Conversion

Note. It is the operator's responsibility to request the services of organizational maintenance when converting to piledriver operation. Organizational maintenance is specifically responsible for proper installation and removal of the piledriver and boom, and will assist operators in proper installation of cables and other accessory items.

a. General. The truck crane may be converted to piledriver operation by installing the crane boom and the piledriver. Paragraph 2-4 lists the crane boom components required. The piledriver consists of the catwalk, piledriver guides, hammer, and leads.

b. Installation.

(1) Install the crane boom, backstops, and boom hoist cable as described in paragraph 2-4.

(2) Place the lead sections on a flat surface in a horizontal position. Bolt one top lead section and four lower lead sections together. Refer to figure 2-16.

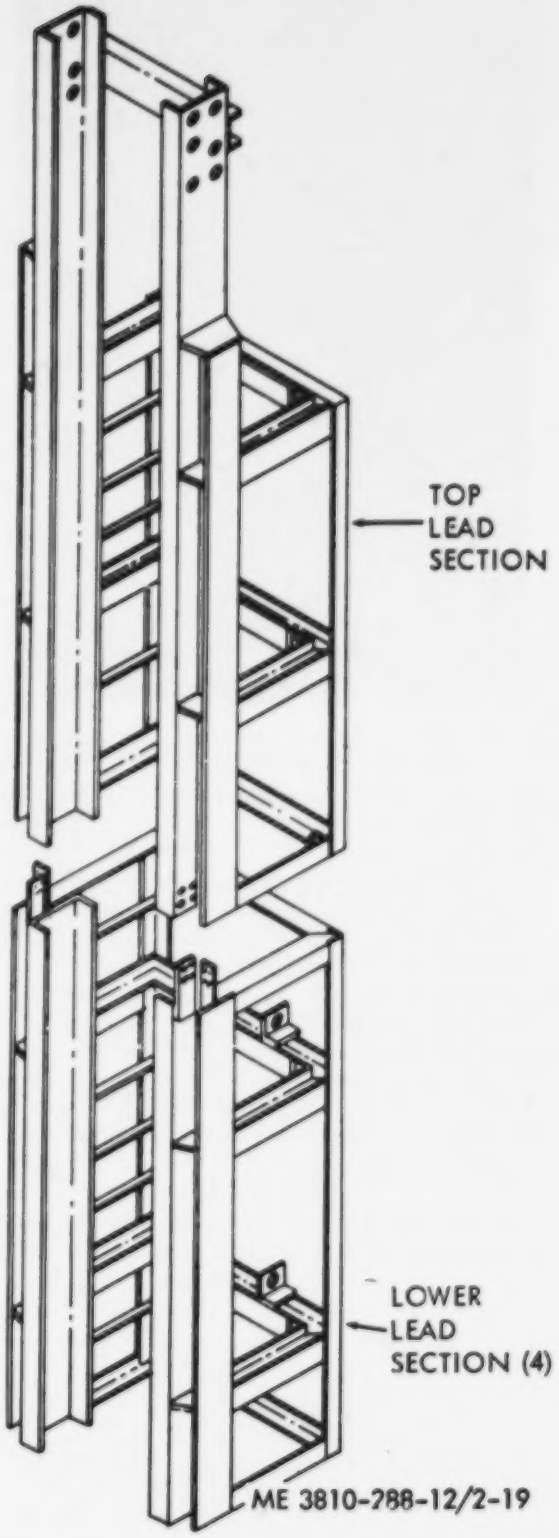

Figure 2-16. Assembling piledriver lead sections.

(3) Lower the boom to horizontal position in line with the upper end of lead assembly, and bolt securely to the outside of adapter plates on the boom point. Refer to figure 2-17.

(4) Install the hammer cable in the drum socket in the rear cable drum and secure with the cable wedge. Lead the hammer cable from the drum out over the left boom point sheave. Refer to figure 2-18.

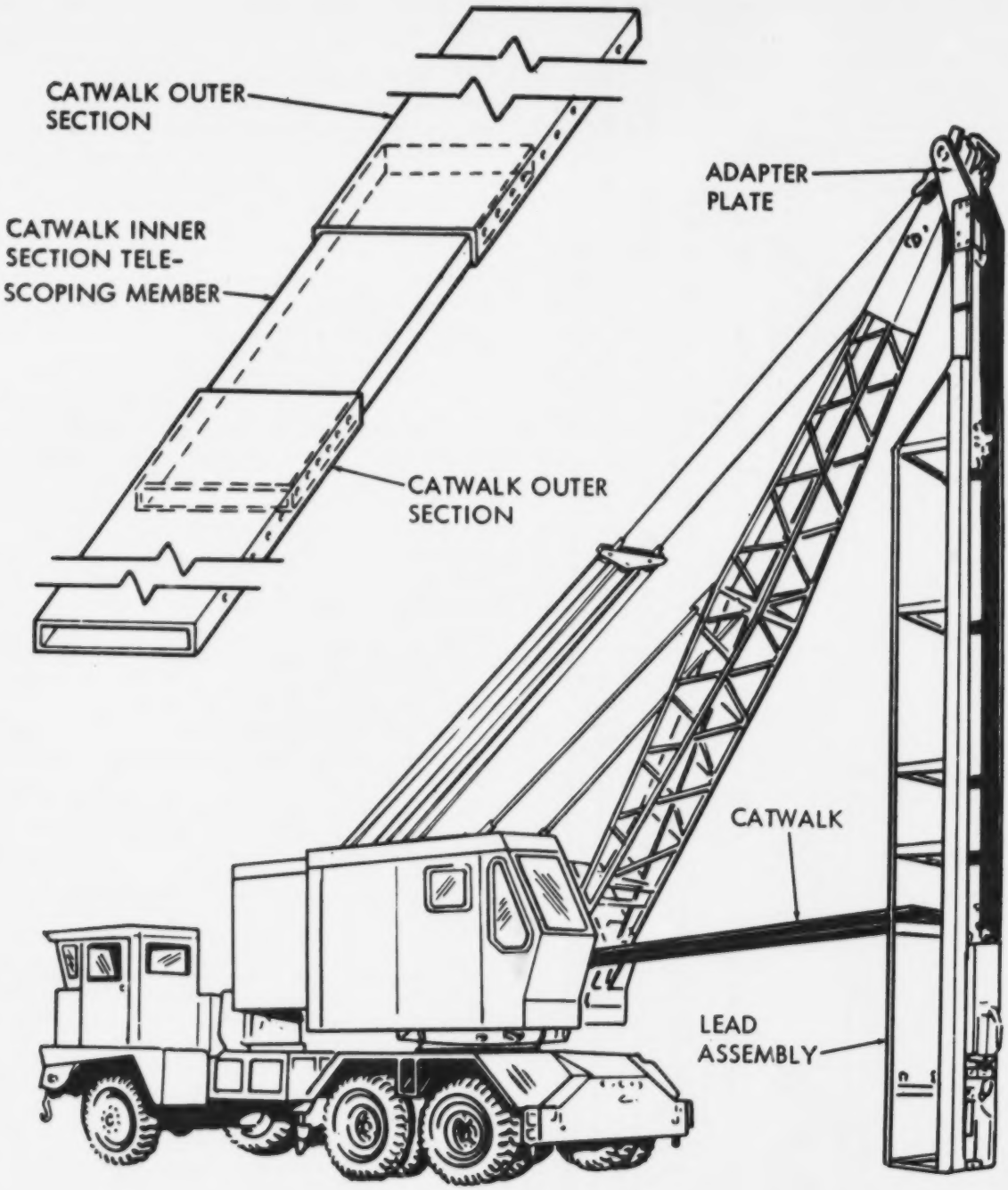

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Figure 2-17. Piledriver lead and adapter installation.

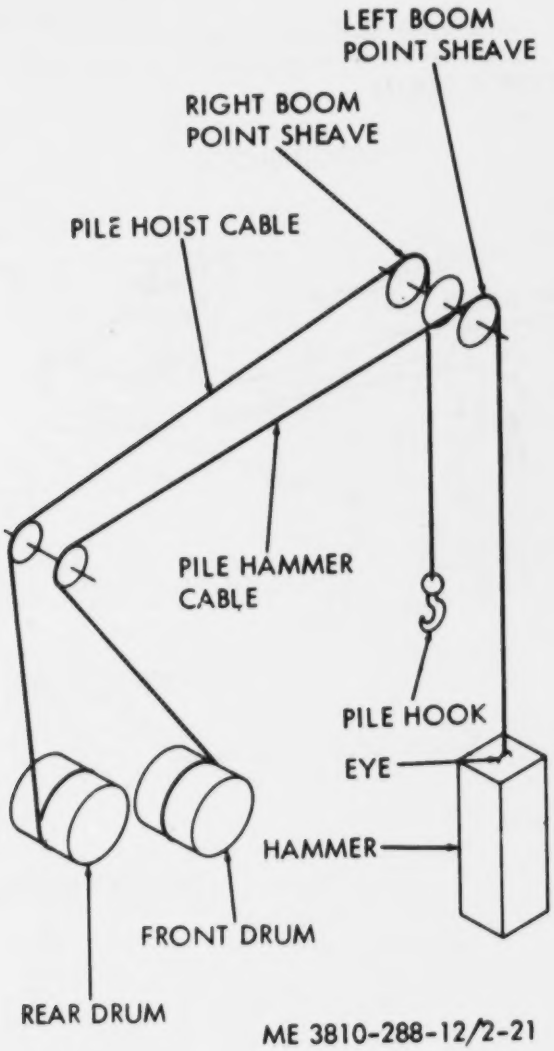


Figure 2-18. Piledriver reeving diagram.

(5) Install the pile hoist cable in the drum socket in the front cable drum and secure with the cable wedge. Lead the pile hoist cable from the drum out over the right boom point sheave.

(6) Install a thimble and the pile hoist cable through the pile hook and secure with three cable clamps.

(7) Back the truck crane slowly toward the piledriver leads, at the same time hoisting the boom until the leads are vertical.

(8) Raise the boom until the bottom of the leads clear the hammer, and position the leads over the hammer.

(9) Secure the piledriver hammer (rear drum) cable to the eye on the top of the hammer with a cable wedge, pin, and cotter pins, and raise the hammer into the leads.

(10) Swing the boom into position over the pile cap. Lower the hammer and secure the pile cap to the hammer with the cable sling. Raise the hammer and lift the cap into the leads.

(11) Refer to figure 2-17 and install the catwalk to the foot of the boom and the leads; adjust the catwalk so the leads are vertical, and bolt the catwalk sections together.

c. Removing the Piledriver.

(1) Lower the hammer enough to allow slack in the cable sling. Remove the sling and move the piledriver clear of the cap.

(2) Remove the bolts and nuts securing the catwalk sections. Raise the boom enough to clear the hammer and lower the hammer to the ground. Remove the cable from the hammer.

(3) Remove the bolts securing the catwalk to the leads and the boom, and lower the catwalk to the ground.

(4) Lower the leads to the ground and slowly drive the carrier forward. At the same time, lower the boom to the wood blocks.

(5) Remove the piledriver lead adapters and leads as shown in figures 2-16 and 2-17. Secure the pile lead adapters to the leads.

(6) Remove the boom hoist cable and boom (para 2-4).

2-8. Backhoe Conversion

Note. It is the operator's responsibility to request the services of organizational maintenance when converting to backhoe operation. Organizational maintenance is specifically responsible for proper installation and removal of the backhoe boom and stick, and will assist operators in proper installation of cables and other accessory items.

a. General. The truck crane may be converted to backhoe operation by installing the backhoe front-end attachment. The following components are necessary for the equipment conversion; backhoe boom, dipper handle, backhoe bucket, pitch brace, drag padlock sheave, hoist padlock sheave, gantry mast, boom foot pins, boom hoist cable, pull cable, and mast suspension cable.

b. Installation.

Note. To install the backhoe boom, a cribbing will be necessary to support the boom in a horizontal position. The cribbing must be high enough to bring the boom into position with the boom foot lugs on the revolving frame, as shown in figure 2-19.

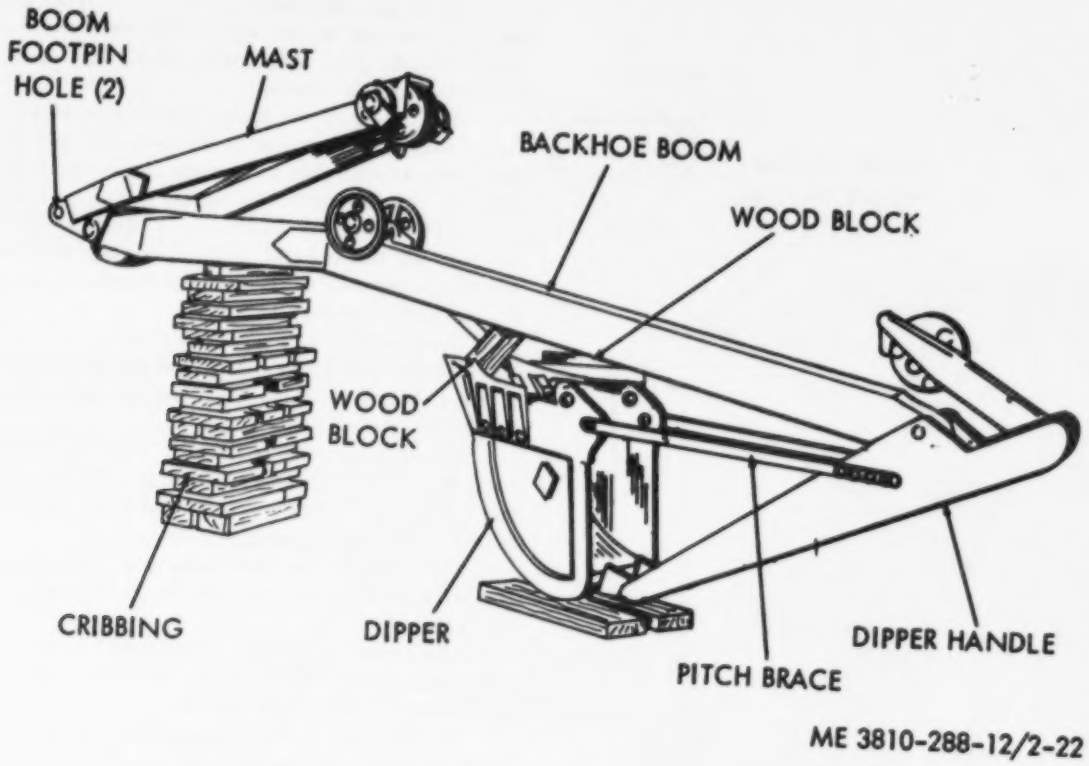


Figure 2-19. Cribbing prepared for backhoe boom assembly, installation and removal.

(1) With the base of the backhoe boom assembly cribbed up to the height of the boom foot lugs on the revolving frame, swing the revolving frame to face the rear of the carrier. Carefully back the carrier up to the cribbed up boom, so that the bores in the boom foot lugs on the revolving frame are alined with the bores in backhoe boom foot. Install the boom to the revolving frame with the boom foot pins and lock plates.

(2) Skid the gantry mast along on top of the boom into place on the revolving frame. Make certain that the small cable guide sheave at the top of the gantry mast points toward the crane, and install the gantry mast foot pins.

(3) Raise the gantry frame by hand, and lean it against the crane cab.

c. *Reeving.*

(1) Unroll and stretch the gantry suspension cable out on the ground on the right side of the boom.

(2) Reeve the backhoe auxiliary gantry cable as shown in figure 2-20.

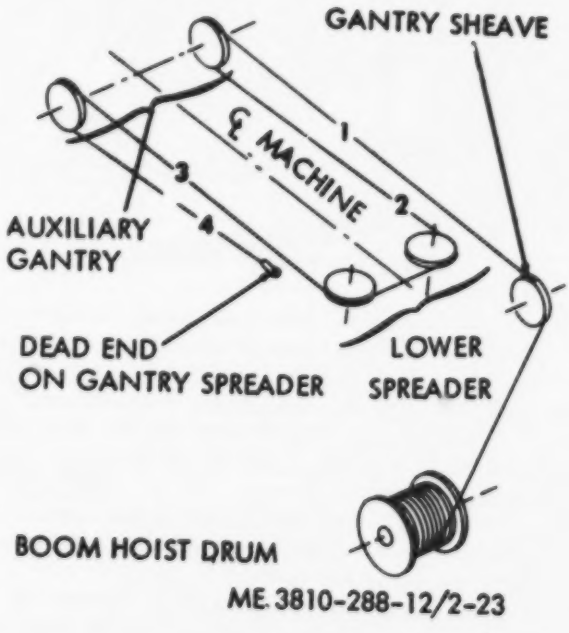


Figure 2-20. Backhoe auxiliary gantry suspension reeving.

(3) Secure the gantry suspension line to the boom hoist drum as shown in figure 2-11. Spool the slack cable on the drum.

(4) Install the gantry frame hold down cable (1½" diameter x 8'-6" long) between the revolving frame and the upper end of the gantry frame.

(5) Unroll and stretch the digging cable out on the ground on the right side of the boom.

(6) Reeve the digging cable as shown in figure 2-21.

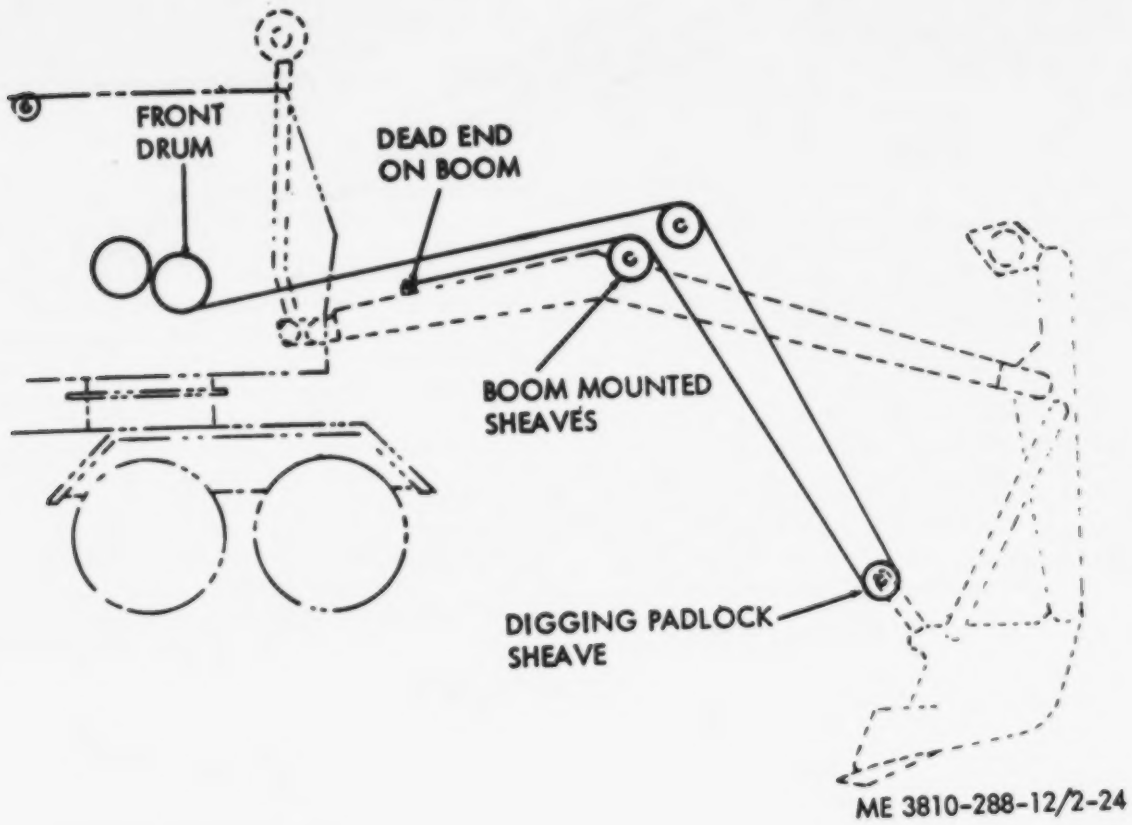


Figure 2-21. Backhoe digging cable reeving.

(7) Secure the digging cable to the cable drum as shown in figure 2-11.

(8) Raise the gantry mast to the working position, using the boom hoist lever. Spool the slack hoist cable on the boom hoist drum slowly, making certain that the cable wraps evenly on the drum the first time.

(9) Unroll and stretch the hoist cable out on the ground on the right side of the boom.

(10) Reeve the hoist cable as shown in figure 2-22.

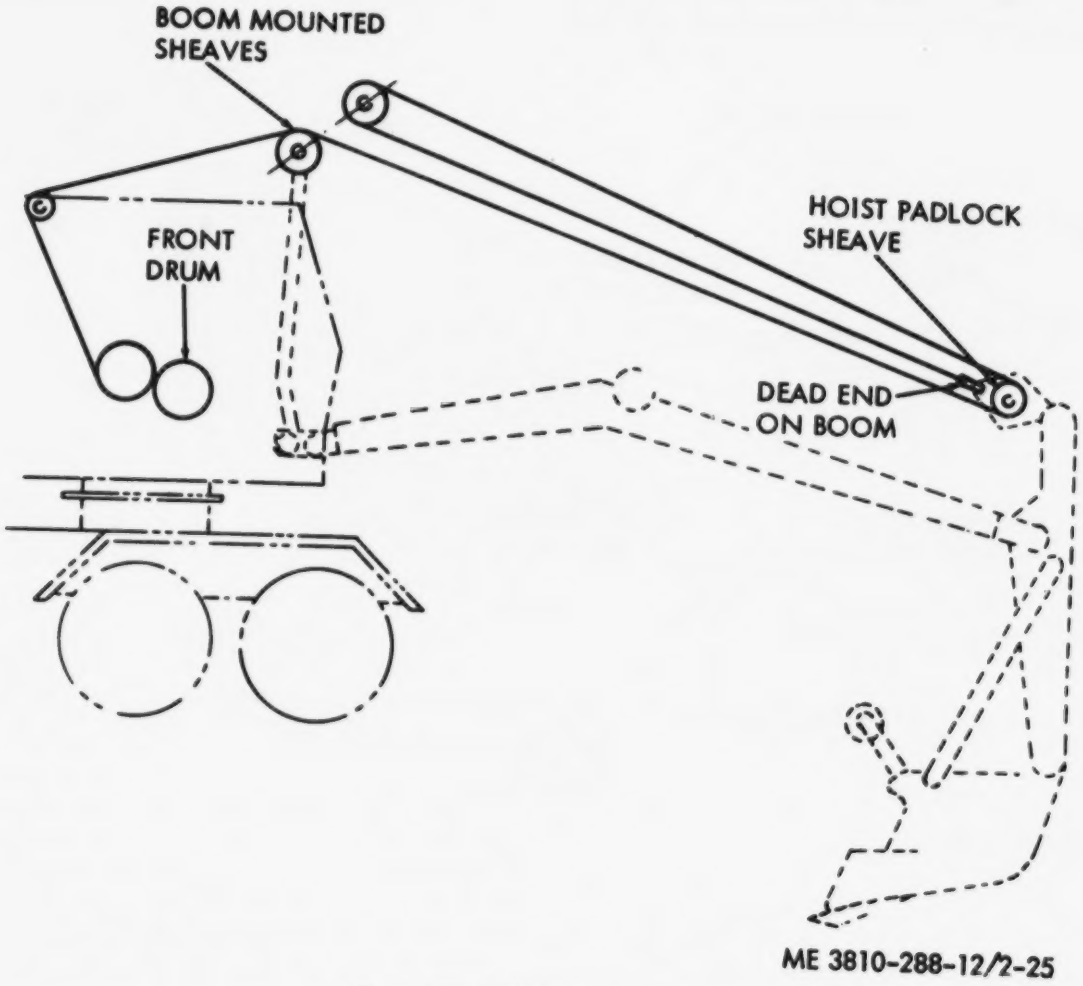


Figure 2-22. Backhoe hoist cable reeving.

(11) Extend the dipper out as far as it will go, with the dipper on the ground. Secure the hoist line to the cable drum as shown in figure 2-11, and take up two wraps on the front cable drum. Secure the other end of the cable to the boom.

d. Adjust the Backhoe Pitch Braces. The backhoe pitch braces (fig. 2-19) contain four holes in each brace for adjustment. Position the backhoe boom over the rear of the carrier and extend the dipper handle until the dipper teeth are in the vertical position. Lower the dipper to the ground and remove the nut and threaded pin which secure the braces to the dipper handle. To shorten the braces, move the carrier backward slowly until the holes in the braces are alined with the holes in the dipper handle. To lengthen the braces, move the carrier forward. After the holes have been alined install the threaded pin and nut.

e. Unreeving the Backhoe Digging Cable.

(1) Pull the dipper in under the boom and lower to the ground.

(2) Release the front cable drum brake, and spool the cable off the drum. Remove the cable wedge from the drum socket and pull the cable free of the drum and the cable guide sheave on the boom.

(3) Remove the wedge from the dead-end socket on the boom and pull the cable free of the padlock, guide sheave, and boom.

(4) Lay the cable out straight on the ground.

(5) Roll the cable into a coil and secure it with wire. Label the cable for future use.

f. Unreeving the Backhoe Hoist Cable.

(1) Release the rear cable drum brake, and spool the cable from the rear cable drum. Remove the cable wedge and pull the cable free of the drum.

(2) Remove the cable wedge from the dead-end socket on the hoist padlock sheave, and pull the cable free of all sheaves.

(3) Lay the cable out straight on the ground.

(4) Roll the cable into a coil and secure it with wire. Label the cable for future use.

g. Unreeving the Backhoe Mast Suspension Cable.

(1) Pull the dipper in under the boom and lower it to the ground.

(2) Slack off on the mast suspension cable and lower the mast forward to rest on the boom.

(3) Spool the cable off the boom hoist drum, and remove the cable wedge from the drum socket.

(4) Remove the wedge from the dead-end socket on the gantry A-frame.

(5) Pull the cable free of all sheaves and the mast. Lay the cable out straight on the ground.

(6) Roll the cable into a coil and secure it with wire. Label the cable for future use.

h. Removing the Backhoe Boom.

(1) Raise the boom and dipper off the ground. Pull the dipper in under the boom, and lower the dipper onto wood blocks (fig. 2-19). Crib the base of the boom as shown in figure 2-19.

(2) Remove all cables. Refer to figures 2-20, 2-21, and 2-22.

(3) Use a wedge between the cribbing and boom to remove the weight of the boom from the boom foot pins.

(4) Remove the boom foot pins, and drive the boom foot pins out of the boom foot lugs, releasing the backhoe boom attachment from the truck crane revolving frame.

(5) Drive the carrier slowly, away from the backhoe attachment.

Caution: **Use care when swinging the revolving frame without a boom, since it will tend to be unbalanced toward the counterweight end.**

2-9. Shovel Conversion

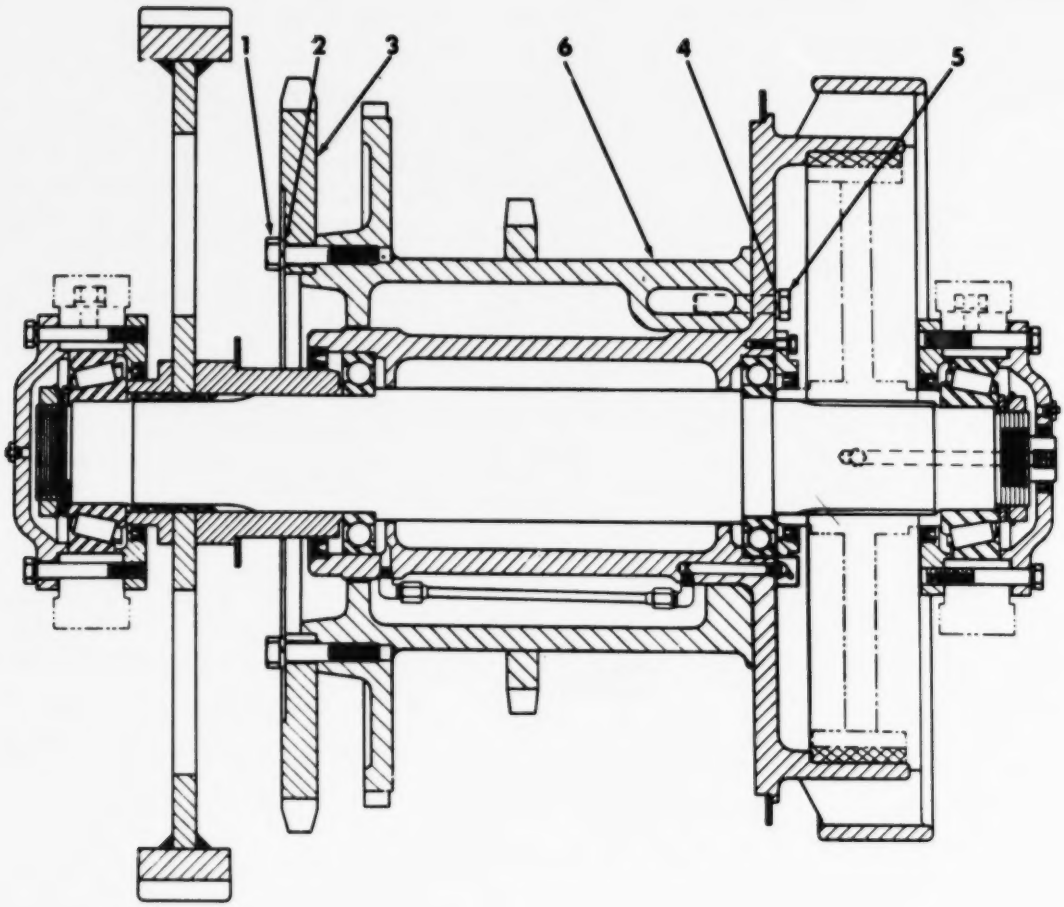
Note. It is the operator's responsibility to request the services of organizational maintenance when converting to shovel operation. Organizational maintenance is specifically responsible for proper installation and removal of the shovel boom and stick, and will assist operators in proper installation of cables and other accessory items.

a. General. The truck crane may be converted to shovel operation by installing the shovel attachment. The following components are necessary for the equipment conversion: the shovel boom, saddle block, dipper stick, dipper, boom foot roller assembly, crowd chain tightener and crowd chain, special shovel front and rear drum laggings which are illustrated in figure 2-23.

Figure 2-23. Shovel drum laggings.

b. Installation.

(1) Install the crowd sprocket lagging on the front drum as instructed on figure 2-24.



STEP 1. REFER TO PARAGRAPH 2-4 AND UNREEVE THE CABLES FROM FRONT AND REAR DRUMS. REFER TO FIGURE 2-23 AND REMOVE COTTER PIN, PIN AND REVERSING CHAIN.

STEP 2. REMOVE CAPSCREWS (5) AND LOCKWASHERS (4). REFER TO FIGURE 2-23 AND REMOVE LAGGING BOLTS.

STEP 3. REMOVE ROPE LAGGING FROM THE FRONT DRUM, AND REMOVE REVERSING SPROCKET HALVES (3) FROM THE LAGGING HALVES BY REMOVING CAPSCREWS (1) AND LOCKWASHERS (2).

STEP 4. INSTALL REVERSING SPROCKET HALVES (3) ON CROWD SPROCKET LAGGING HALVES AND INSTALL THE CROWD SPROCKET LAGGING ON THE FRONT DRUM. INSTALL CAPSCREWS (5) AND LOCKWASHERS (4).

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Figure 2-24. Installing crowd sprocket lagging.

(2) Install the split rear drum lagging on the rear drum as shown on figure 2-23.

(3) Install the crowd chain tightener as instructed on figure 2-25.

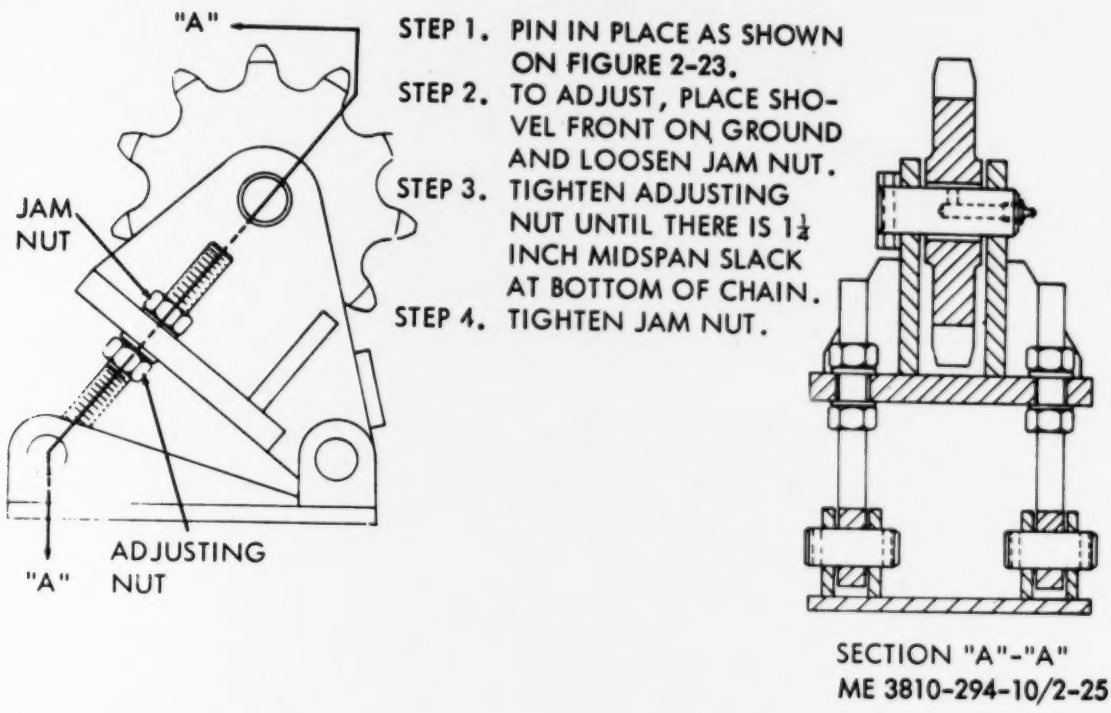
"A"
JAM NUT
ADJUSTING NUT
"A"
STEP 1. PIN IN PLACE AS SHOWN ON FIGURE 2-23.
STEP 2. TO ADJUST, PLACE SHOVEL FRONT ON GROUND AND LOOSEN JAM NUT.
STEP 3. TIGHTEN ADJUSTING NUT UNTIL THERE IS 1¼ INCH MIDSPAN SLACK AT BOTTOM OF CHAIN.
STEP 4. TIGHTEN JAM NUT.
SECTION "A"-"A"
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Figure 2-25. Crowd chain tightener.

(4) With the shovel boom cribbed to the height of the revolving frame boom foot lug holes (fig. 2-26), back the truck crane to the boom and aline the boom foot pin holes in the boom with those in the revolving frame.

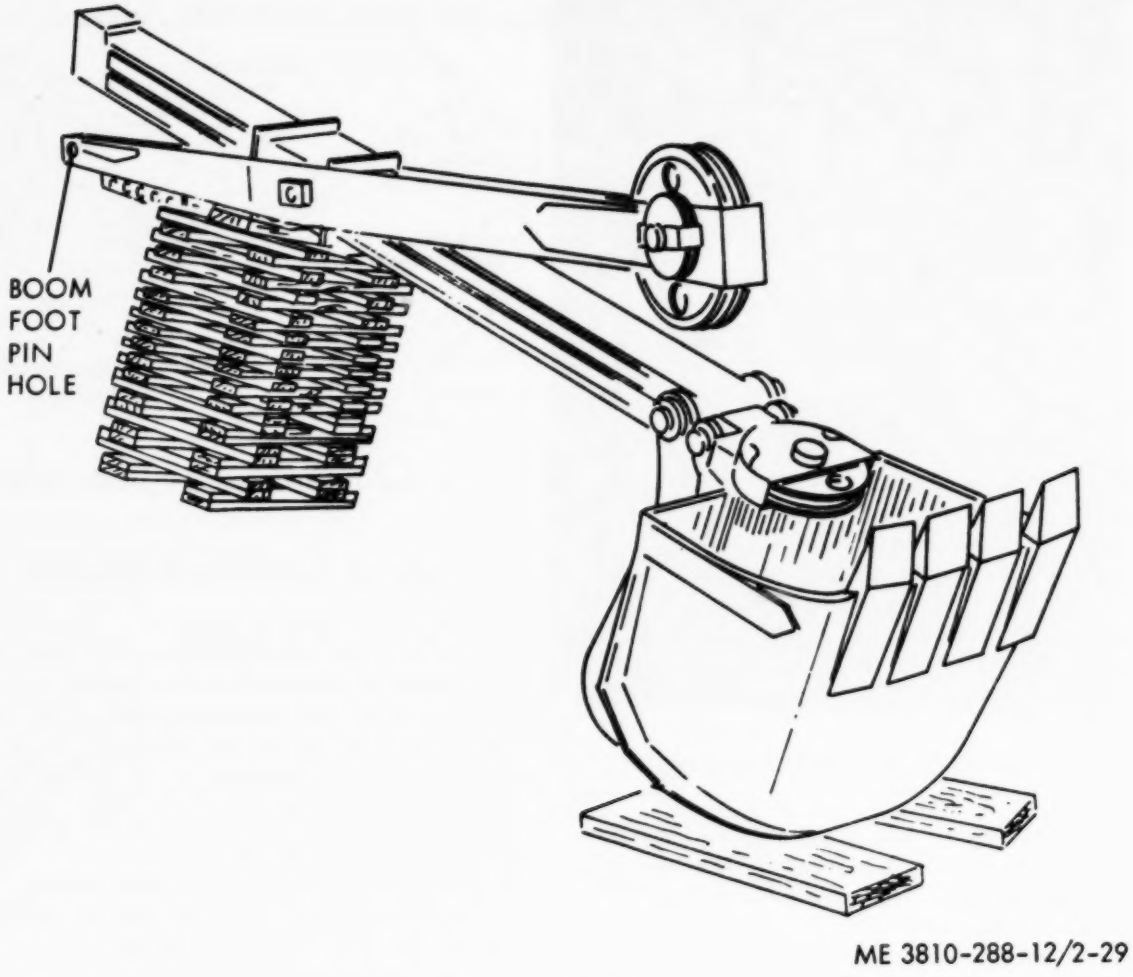

Figure 2-26. Cribbing the shovel boom assembly.

(5) Install the boom foot pin through the left boom foot lug. Using a suitable lifting device, support the boom foot drum in position, and install the boom foot pin through the drum and the right boom foot lug. Install the boom foot pin retaining plates, capscrews, lockwashers, and nuts (fig. 2-27). Connect the electrical line to the dipper trip motor.

Figure 2-27. Shovel boom installation.

(6) Install the crowd chain around the front drum sprocket, boom foot drum sprocket, and over the chain tightener. Adjust the chain as described in paragraph 3-27.

c. Reeving Crowd Cable.

(1) Unroll and stretch the crowd cable out on the ground on the right side of the boom.

(2) Reeve one end of the crowd cable under and around the boom foot drum, to the right cable socket on the drum, and secure the cable to the drum as shown in figure 2-11.

(3) Reeve the other end of the crowd cable around the front of the right groove in the shipper shaft roller, around the dipper stick rope thimble, around the front of the left groove in the shipper shaft roller, under and around the boom foot drum, to the left cable socket on the drum, and secure the cable to the drum (fig. 2-28).

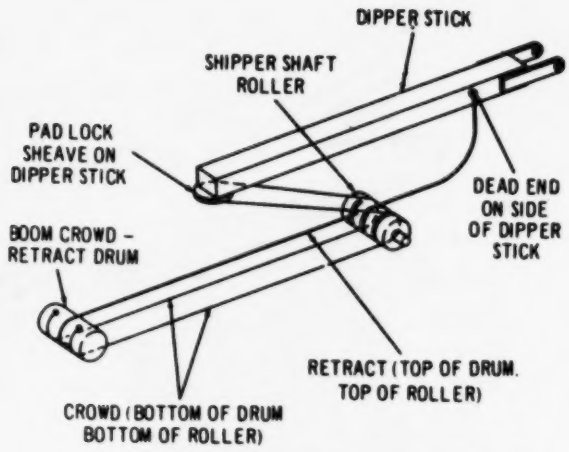
DIPPER STICK
SHIPPER SHAFT ROLLER
PAD LOCK SHEAVE ON DIPPER STICK
DEAD END ON SIDE OF DIPPER STICK
BOOM CROWD - RETRACT DRUM
RETRACT (TOP OF DRUM. TOP OF ROLLER)
CROWD (BOTTOM OF DRUM BOTTOM OF ROLLER)
ME 3810-288-12/2-31

Figure 2-28. Crowd and retract cable reeving.

d. Retract Cable Reeving.

(1) Unroll and stretch the retract cable out on the ground on the right side of the boom.

(2) Secure one end of the cable to the dipper stick (fig. 2-28). Reeve the other end of the cable over the top of the center groove in the shipper shaft roller, and over and around the boom foot drum. Wrap the excess length around the drum, and secure the end to the drum.

e. Reeving Shovel Dipper Hoist Cable.

(1) Unroll and stretch the dipper hoist cable out on the right side of the boom.

(2) Reeve one end of the cable up and over the left boom point sheave, down the top side of the boom, and over the left cable drum.

(3) Insert the end of the cable through the cable dead-end socket, loop it and insert the end of the cable back into the socket, taking care that the end does not protrude all the way through. Insert the cable wedge into the socket and pull the cable tight around it.

(4) Reeve the remaining free end of the cable around the padlock sheave on the shovel, dipper, up and over the right boom point sheave, and to the cable socket on the boom (fig. 2-29).

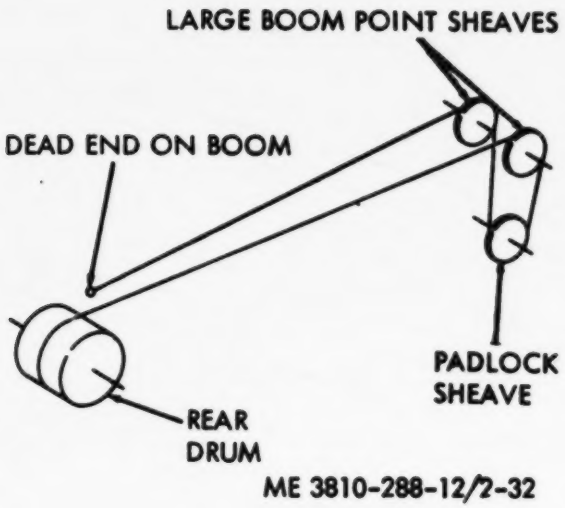

Figure 2-29. Dipper hoist cable reeving.

f. Reeving Shovel Boom Hoist Cable.

(1) Unroll and stretch the boom hoist cable out on the ground on the right side of the boom.

(2) Reeve one end of the cable around the lower left gantry spreader sheave, around the inside left boom point sheave, around the upper gantry spreader sheave, around the outside left boom point sheave, and back to the dead-end on the gantry spreader (fig. 2-30).

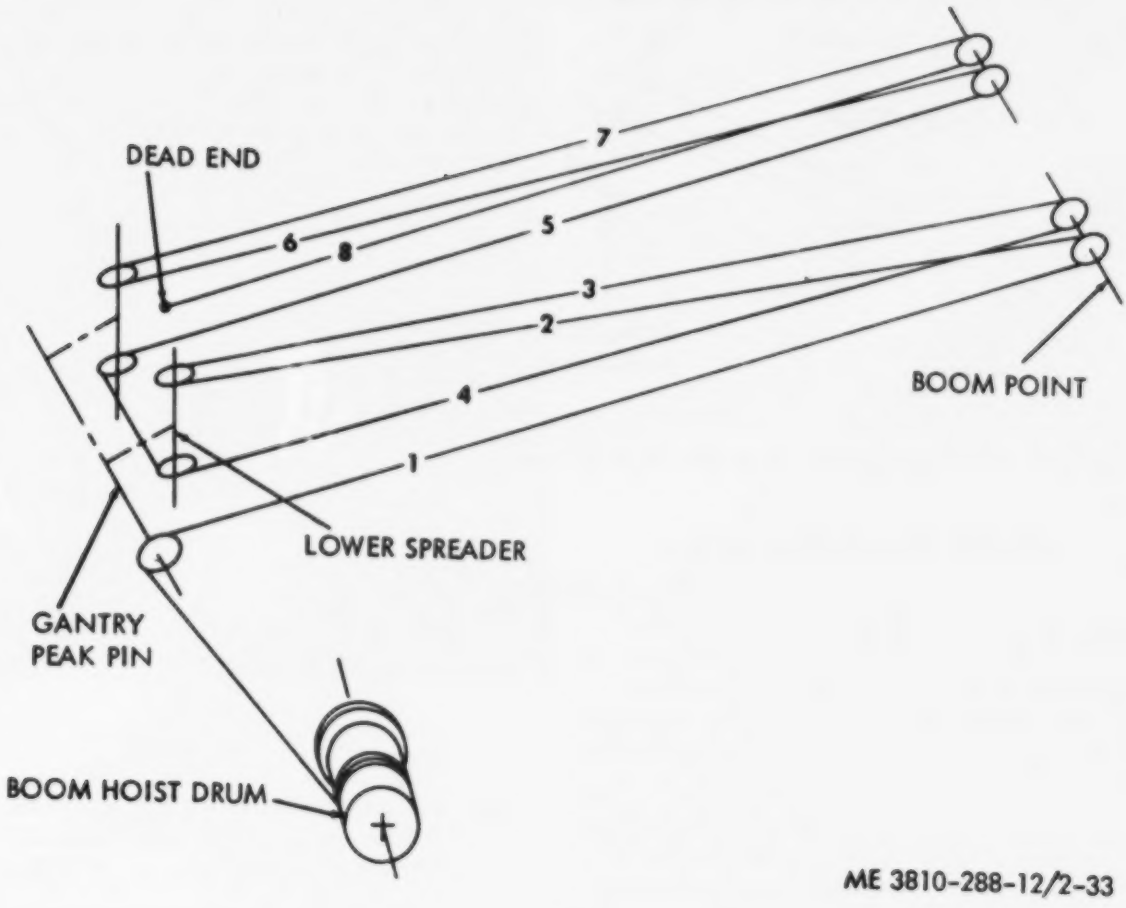

Figure 2-30. Boom hoist cable reeving.

(3) Reeve the other end of the boom hoist cable around the lower right gantry spreader sheave, around the inside right boom point sheave, around the upper right gantry spreader sheave, around the outside right boom point sheave, and down to the boom hoist drum.

(4) Secure the boom hoist line to the boom hoist drum as shown in figure 2-11.

(5) Spool the slack cable on the drum.

g. Reeving Shovel Dipper Trip Cable.

(1) Raise the dipper off the ground and crowd it out as far as it will go, and then lower it to the ground.

(2) Unroll and stretch the dipper trip cable out on the ground on the right side of the boom.

(3) Reeve the cable from the trip lever on the dipper stick, over the small sheaves on the shipper shaft, around the dipper trip motor eccentric, around the outside sheave on the shipper shaft, and back to the dead-end on the dipper stick (fig 2-31).

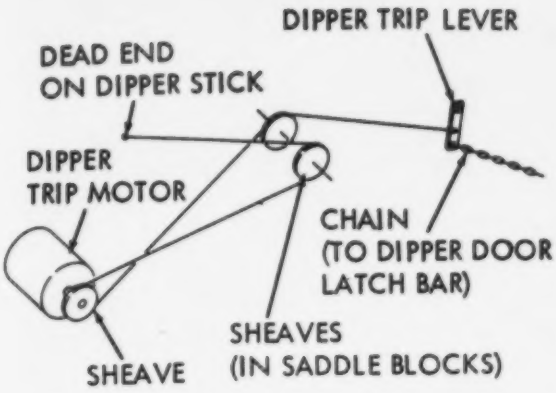

Figure 2-31. Dipper trip cable reeving.

h. Adjustments. All shovel front adjustments are covered in paragraph 3-27. Each adjustment listed in paragraph 3-27 must be made or checked before a machine converted to shovel operation is placed in service.

i. Unreeving Shovel Cables.

(1) To unreeve the shovel dipper trip cable, remove the cable clamp at the dipper trip lever and the dead end on the dipper stick. Pull the cable from the drum and sheaves. Coil the cable neatly and secure with wire. Label the cable for future use.

(2) To unreeve the boom hoist cable, hoist the dipper up and crowd it out beyond the boom point sheaves. Lower the boom onto blocking (fig. 2-26). Unspool the cable from the drum. Remove the cable wedge from the cable drum socket and free the cable. Pull the cable free of the drum and the boom point sheaves, and lay it out straight on the ground. Roll the cable into a coil and secure it with wire. Label the cable for future use.

j. Removing Shovel.

(1) Prepare cribbing (fig. 2-26) under the base of the boom. Unreeve the hoist cable as described above.

(2) Remove the crowd chain by removing the cotter pin, pin, and connecting link. Lubricate with OE, label, and store the chain.

(3) Disconnect the electrical line to the dipper trip motor.

(4) Remove capscrews, lockwashers, and the retaining plates at the boom foot pins, and remove the boom foot pins and boom foot drum from the revolving frame.

(5) Drive the carrier clear of the shovel boom assembly.

(6) Remove the front drum sprocket lagging. Coat the sprocket lagging and the boom foot drum sprocket with oil to prevent rust.

2-10. Controls and Instruments

a. General. The crane operating controls and instruments are shown in figure 2-32. A description of each control is given below.

Note. The operator must study the information in this section, and be thoroughly familiar with the location and function of each control, before attempting to operate the machine.

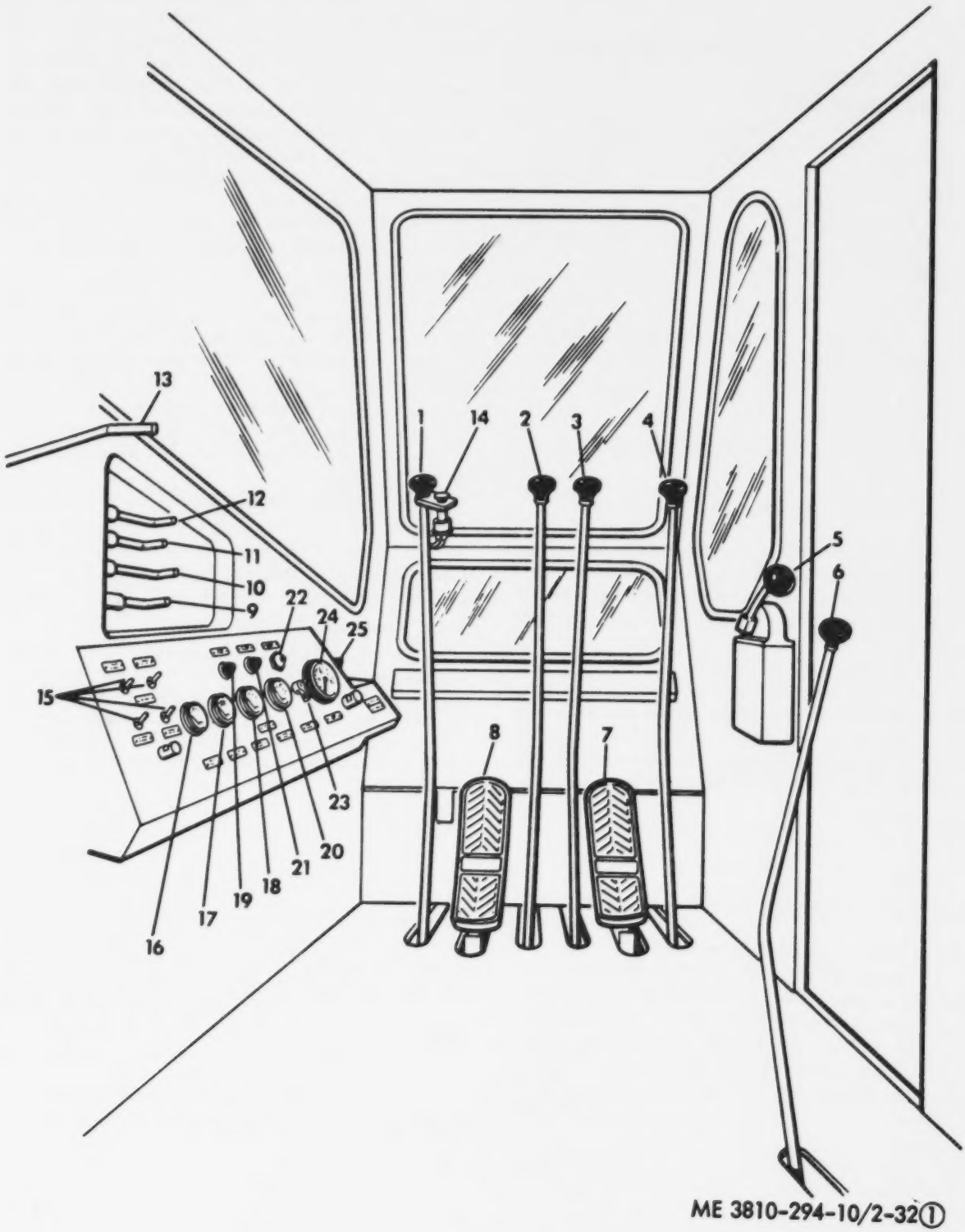

Figure 2-32. Control identification (sheet 1 of 2).

KEY to fig. 2-32 (sheets 1 and 2):

1. Swing clutch lever
2. Front drum clutch lever
3. Rear drum clutch lever
4. Boom hoist clutch and brake lever
5. Engine throttle control
6. Swing brake lever
7. Rear drum brake pedal
8. Front drum brake pedal
9. Swing brake lock control
10. Boom hoist drum pawl control
11. Front drum pawl control
12. Rear drum pawl control
13. Engine clutch lever
14. Horn button (or dipper trip switch)
15. Light switches
16. Engine fuel tank level gauge
17. Voltmeter
18. Engine oil pressure gauge
19. Engine oil pressure warning light
20. Engine temperature gauge
21. Engine temperature warning light
22. Starter button (engine)
23. Ignition switch
24. Engine tachometer
25. Choke control
26. Rain shutter lever

Figure 2-32. Control identification (sheet 2 of 2).

b. Control / Instrument Identification.

(1) *Swing clutch lever.* Push this lever forward (toward the boom point) to swing the upper to the left. Pull this lever backward to swing the upper to the right.

(2) *Front drum clutch lever.* Pull this lever backward (toward the operator) to wrap line on the front drum. Push this lever forward (away from the operator) to pay line off the front drum.

(3) *Rear drum clutch lever.* Pull this lever backward (toward the operator) to wrap line on the rear drum. Push this lever forward (away from the operator) to pay line off the rear drum.

(4) *Boom hoist clutch and brake lever.* Pull this lever backward (toward the operator) to wrap line on the boom hoist drum and raise the boom. Push this lever forward (away from the operator) to pay line off the boom hoist drum and lower the boom. Return the lever to the center (neutral) position to apply the boom hoist brake.

Note. The boom hoist drum pawl control (item 10 of this listing) must be used in conjunction with the boom hoist clutch and brake lever.

(5) *Engine throttle control.* Move this control forward to increase the engine speed. Move this control backward (toward the operator) to decrease engine speed.

(6) *Swing brake lever.* Push this lever fully forward to apply the swing brake. Pull this lever fully backward to release the swing brake.

(7) *Rear drum brake pedal.* Push this pedal down to apply the rear drum brake. Release pressure on the pedal to release the rear drum brake. To engage the ratchet type lock on this pedal, depress the toe of the pedal while releasing pressure on the pedal. To disengage the ratchet type lock, depress the heel of the pedal.

Caution: Do not rely on the ratchet brake locks on the front or rear drum brake pedals to suspend a load. The operator must remain in a position of readiness, with feet on pedals, at all times that a load is suspended.

(8) *Front drum brake pedal.* Push this pedal down to apply the front drum brake. Release pressure on the pedal to release the front drum brake. To engage the ratchet type lock on this pedal, depress the toe of the pedal while releasing pressure on the pedal. To disengage the ratchet type lock, depress the heel of the pedal.

(9) *Swing brake lock control.* Push this handle backward to engage the mechanical swing brake lock.

(10) *Boom hoist drum pawl control.* Push this handle backward to engage the safety pawl in the boom hoist drum ratchet.

Caution: The boom hoist pawl must be engaged at all times, except when lowering the boom. Do not attempt to engage the boom hoist pawl while lowering the boom.

(11) *Front drum pawl control.* Push this handle backward to engage the safety pawl in the front drum ratchet.

Caution: The front drum pawl must be engaged while suspending a load. Do not attempt to engage this pawl while lowering a load.

(12) *Rear drum pawl control.* Push this handle backward to engage the safety pawl in the rear drum ratchet.

Caution: The rear drum pawl must be engaged while suspending a load on the rear

drum line. Do not attempt to engage this pawl while lowering a load.

(13) *Engine clutch and boom hoist planetary pawl lever.* Pull this lever fully backward to engage the engine clutch and boom hoist planetary pawls. Push this lever fully forward to disengage the clutch and pawls.

(14) *Horn button.* Depress this button to sound the warning horn.

(15) *Light switches.* Use these switches to control the top and skirt mounted floodlights, interior cab light, and the panel illumination lights, as labeled.

(16) *Engine fuel tank level gauge.* This gauge indicates the level of the fuel in the crane engine fuel tank.

(17) *Voltmeter.* This meter indicates the condition of the battery, and the voltage output of the alternator when the engine is running. Typical indications of this meter are shown in figure 2-33.

Engine not running or running at slow idle.		Engine running fast enough to make generator* produce.
❶ DEAD OR DISCONNECTED BATTERY. DISCONNECTED OR BADLY CONNECTED METER.		❶ DISCONNECTED METER. ENGINE COULD NOT RUN WITH DEAD OR DISCONNECTED BATTERY UNLESS CIRCUIT WAS COMPLETED AROUND BATTERY.
❷ VERY LOW BATTERY CHARGE. ENGINE MIGHT NOT START.		❷ ❸ WHEN METER POINTER STAYS BELOW 13.3 WITH THE ENGINE RUNNING FAST ENOUGH TO OPERATE GENERATOR, IT SHOWS THAT GENERATOR IS NOT OPERATING OR VOLTAGE REGULATOR IS OUT OF ADJUSTMENT, OR THAT CURRENT BEING DRAWN FROM BATTERY BY LIGHTS, HEATER FAN, OR OTHER LOAD, EXCEEDS GENERATOR OUTPUT.
❸ LOW BATTERY CHARGE. CONSTANT READING IN THIS AREA WOULD INDICATE NEED FOR CHECK ON GENERATOR AND VOLTAGE REGULATOR.		
❹ WELL-CHARGED BATTERY. THIS INDICATES A GOOD BATTERY AND ALSO THAT GENERATOR AND VOLTAGE REGULATOR ARE OPERATING PROPERLY.		❹ ❺ WHEN ENGINE IS STARTED, POINTER MAY STAY IN THIS AREA TEMPORARILY BUT SHOULD GRADUALLY RISE ABOVE 13.3 AS GENERATOR REACHES NORMAL OUTPUT.
❺ THE POINTER MIGHT REMAIN IN THIS POSITION TEMPORARILY WHEN THE ENGINE HAS BEEN STOPPED AFTER CONSIDERABLE USE, DUE TO A "SURFACE CHARGE" IN THE BATTERY. TO GET A CORRECT READING, TURN ON HEADLIGHTS FOR A FEW MINUTES.		
❻ ❼ UNDER NORMAL CONDITIONS, A 12V BATTERY IS FULLY CHARGED AT 12.8V. A SLIGHTLY HIGHER READING MAY OCCUR UNDER THE CONDITIONS OUTLINED IN NO. 5 BUT, GENERALLY SPEAKING, ANY READING ABOVE 12.8 WHEN THE ENGINE IS STOPPED IS NOT A TRUE READING. NOTE: THE WORD GENERATOR REFERS TO BOTH GENERATOR AND ALTERNATOR SINCE BOTH REQUIRE THE SAME INSTRUMENTATION.		❻ THIS IS THE AREA IN WHICH THE POINTER SHOULD BE WHEN GENERATOR, VOLTAGE REGULATOR AND BATTERY ARE ALL IN GOOD CONDITION AND WORKING PROPERLY.
		❼ WHEN THE POINTER GOES ABOVE 15.2, THE VOLTAGE REGULATOR IS SET TOO HIGH OR IS JAMMED AND CONTINUED OPERATION OF THE ENGINE WILL BURN OUT THE BATTERY.

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Figure 2-33. Voltmeter indications.

(18) *Engine oil pressure gage.* This gage indicates the oil pressure in the crane engine.

(19) *Engine oil pressure warning light.* This light will be illuminated when the oil pressure in the crane engine is below a safe minimum.

(20) *Engine temperature gage.* This gage indicates the temperature of the coolant in the crane engine cooling system in degrees Fahrenheit.

(21) *Engine temperature warning light.* This light will be illuminated when the temperature of the coolant in the crane engine cooling system is above a safe maximum.

(22) *Starter button.* Depress this button to start the engine.

(23) *Ignition switch.* Turn this switch clockwise to turn on the engine ignition. Turn this switch counter-clockwise to turn off the engine ignition.

(24) *Engine tachometer - hourmeter.* This gage indicates the engine speed in hundreds of revolutions per minute. It also contains an hourmeter, which indicates accumulated engine operating hours.

(25) *Choke control.* Lift this knob to close the carburetor choke valve.

(26) *Rain shutter lever.* Open shutter when engine is to be operated.

2-11. Starting

a. Preparation for Starting.

(1) Perform the pre-operation services (para 2-1).

(2) Lubricate the truck crane, as specified in the current LO.

(3) Open the engine rain shutters. Refer to figure 2-32.

b. Starting Crane Engine. Refer to figure 2-34 and start the crane engine.

STEP 1. PUSH ENGINE CLUTCH LEVER FORWARD TO DISENGAGE CLUTCH.
STEP 2. ADVANCE HAND THROTTLE LEVER HALFWAY.
STEP 3. USE CHOKE AS REQUIRED.
STEP 4. TURN IGNITION SWITCH ON.
STEP 5. DEPRESS STARTER BUTTON. RELEASE WHEN ENGINE STARTS.
CAUTION: DO NOT CRANK ENGINE FOR MORE THAN 30 SECONDS CONTINUOUSLY WITHOUT ALLOWING A 2-MINUTE COOLING PERIOD. IF ENGINE DOES NOT START AFTER A FEW TRIES, STOP CRANKING. DETERMINE CAUSE AND CORRECT OR REPORT CONDITION TO ORGANIZATIONAL MAINTENANCE.
STEP 6. RETURN CHOKE TO OPEN POSITION. CHECK FOR WARNING LIGHT OR ABNORMAL GAUGE INDICATIONS.

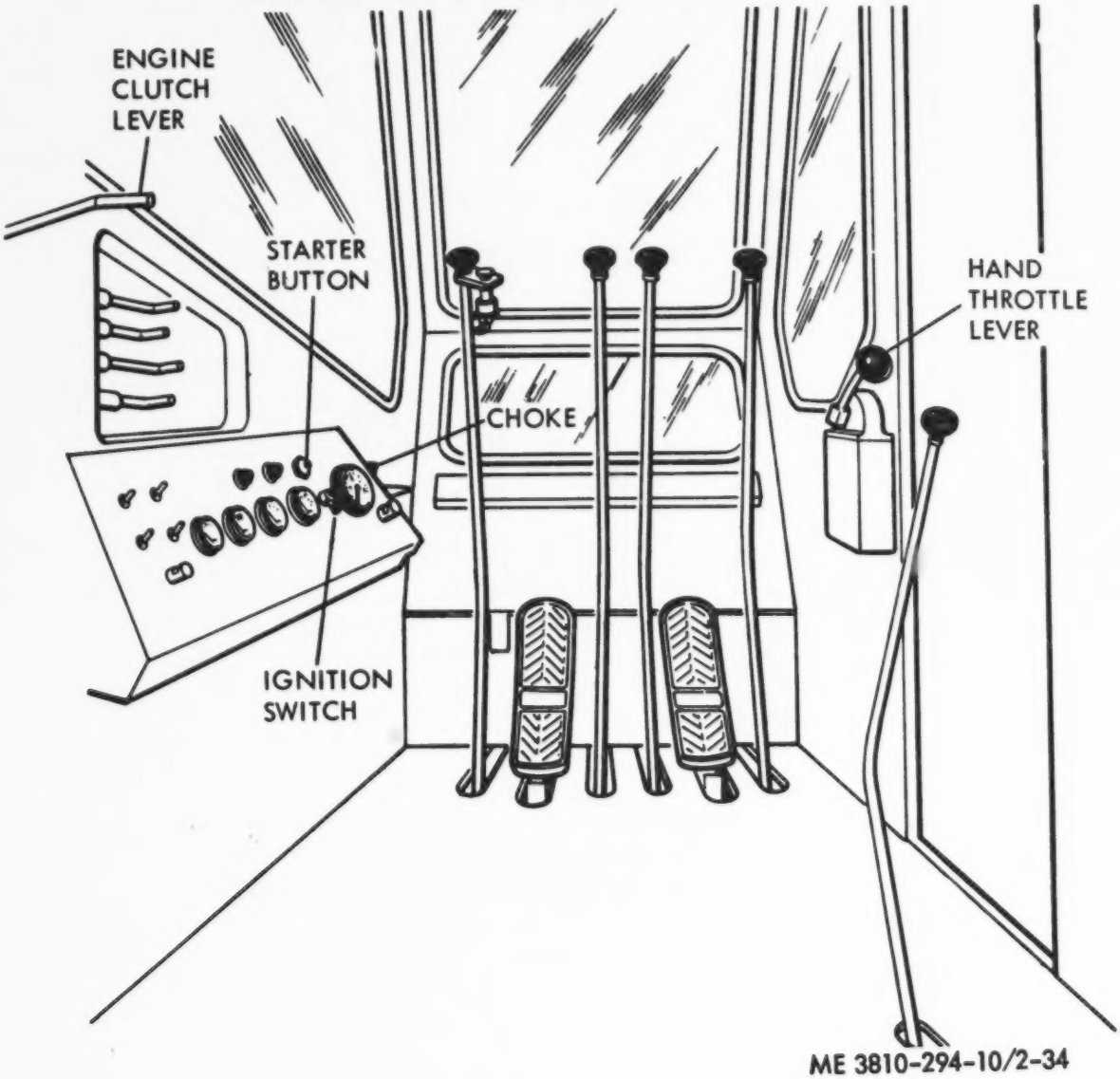


Figure 2-31. Starting crane engine.

c. *Engine Warmup.* Start the engine and bring it to a fast idle (approx. 1,500 rpm) until normal operating temperature is reached, and the oil pressure gauge shows operating readings.

(1) At low temperatures, warmup time can be reduced by keeping doors and openings in the cab closed.

(2) Watch the engine oil pressure gauge closely. If the gauge does not indicate oil pressure within 15 seconds after starting the engine, stop the engine and report this condition to organizational maintenance.

2-12. Stopping

a. Refer to figure 2-35 and stop the crane engine.

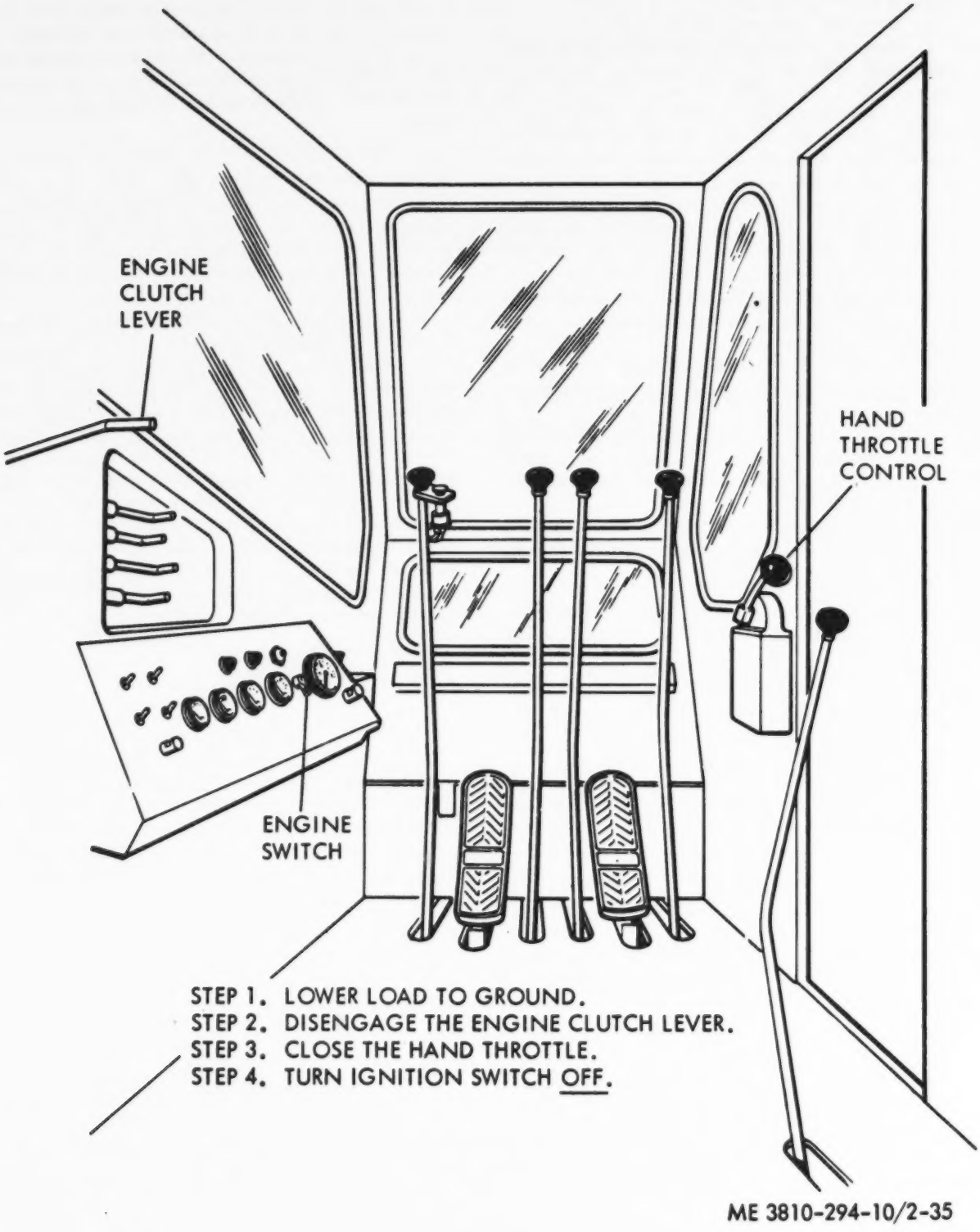


Figure 2-35. Stopping crane engine.

b. Close rain shutters (fig. 2-32).

2-13. Starting the Crane

a. Start the crane engine (para 2-11).

b. Make certain that all operating clutches are disengaged and that all brakes are set. Engage the engine clutch, and listen for noisy operation.

c. Check the drum brakes by applying the brakes and engaging the drum clutches very slightly, pulling against the set brakes. Any slipping of the brakes will be felt and seen.

d. If possible lift a maximum load a few inches above the ground and make certain that it is held without drifting. If the brakes will not hold the load, report to organizational maintenance.

e. Release each drum brake in turn, and try the drum clutches for smooth engagement and responsive operation.

f. During an operational test, make a check for leaks from fuel and oil lines, and from the cooling system.

g. Check all housings for overheating. Prolonged use of brakes or clutches, in excess of normal operation, will cause overheating, lining wear, and damaged drums.

h. If there is evidence of equipment failure, report the condition to organizational maintenance.

2-14. Stopping the Crane

a. Place all control levers in the neutral position.

b. Make certain that the swing brake is set, and that the load or hook block has been lowered to the ground.

c. Close the hand throttle. If possible, allow the engine to run at half speed or less for several minutes before closing the throttle and stopping the engine. This will allow the engine to cool down and will prevent overheating due to localized residual heat.

d. Stop the crane engine (fig. 2-35).

2-15. Crane Operation

a. General. The model M320T2 truck crane, with the crane boom installed and reeved for crane operation is capable of accurate placement of a load at an elevation above or below the level of the crane cab.

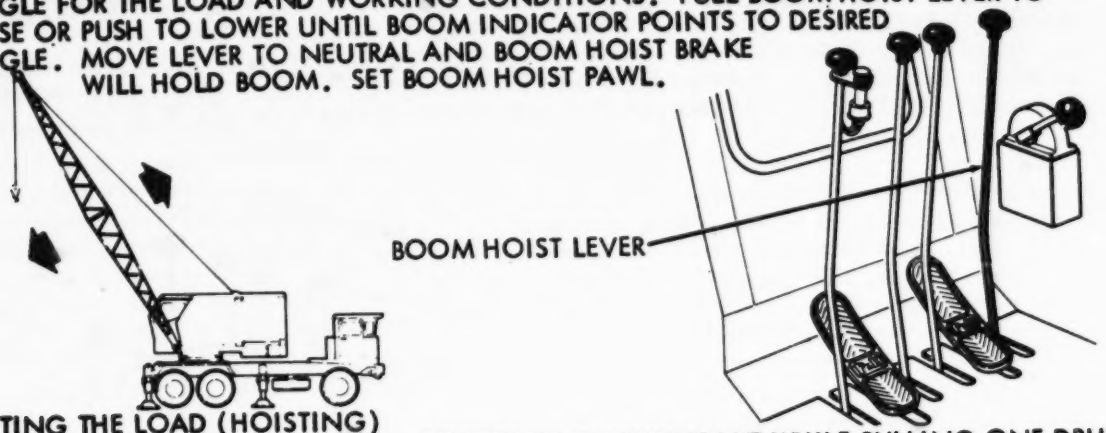
b. Load Limits. Refer to paragraph 1-4 for load limits before starting operation.

c. Positioning the Carrier. Back the carrier to the work site so that most of the work will be performed over the rear of the carrier. Dumping or unloading should be done over the sides of the carrier, if possible. Set the carrier brakes, and extend and set the outriggers. Refer to figure 2-2.

d. Operating cycle. The crane operating cycle consists of five steps: setting the boom angle (boom hoist operation), lifting the load (hoisting), swinging the load, spotting the load, and lowering the load. Start the crane engine (para 2-11) and operate the crane as shown on figure 2-36.

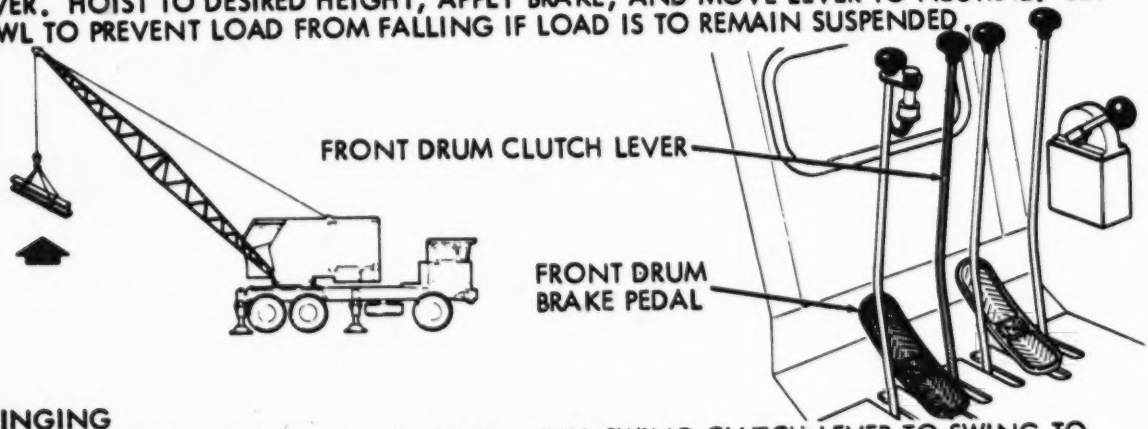
SETTING BOOM ANGLE

FOR HOISTING OPERATION WHEN CRANE BOOM IS USED, POSITION BOOM AT PROPER ANGLE FOR THE LOAD AND WORKING CONDITIONS. PULL BOOM HOIST LEVER TO RAISE OR PUSH TO LOWER UNTIL BOOM INDICATOR POINTS TO DESIRED ANGLE. MOVE LEVER TO NEUTRAL AND BOOM HOIST BRAKE WILL HOLD BOOM. SET BOOM HOIST PAWL.



LIFTING THE LOAD (HOISTING)

ATTACH HOOK BLOCK TO LOAD. RELEASE ONE DRUM BRAKE WHILE PULLING ONE DRUM LEVER. HOIST TO DESIRED HEIGHT, APPLY BRAKE, AND MOVE LEVER TO NEUTRAL. SET PAWL TO PREVENT LOAD FROM FALLING IF LOAD IS TO REMAIN SUSPENDED.



SWINGING

KEEP DRUM BRAKE ON WHILE SWINGING. PULL SWING CLUTCH LEVER TO SWING TO RIGHT, PUSH TO SWING TO LEFT. ENGAGE SLOWLY SO SWING WILL BE SMOOTH. TO STOP SWING, ENGAGE LEVER IN OPPOSITE SWING POSITION GENTLY. SWINGING AND HOISTING CAN BE DONE SIMULTANEOUSLY. ENGAGE THE SWING BRAKE LEVER TO KEEP CAB FROM DRIFTING WHEN ACCURATE SPOTTING IS REQUIRED.

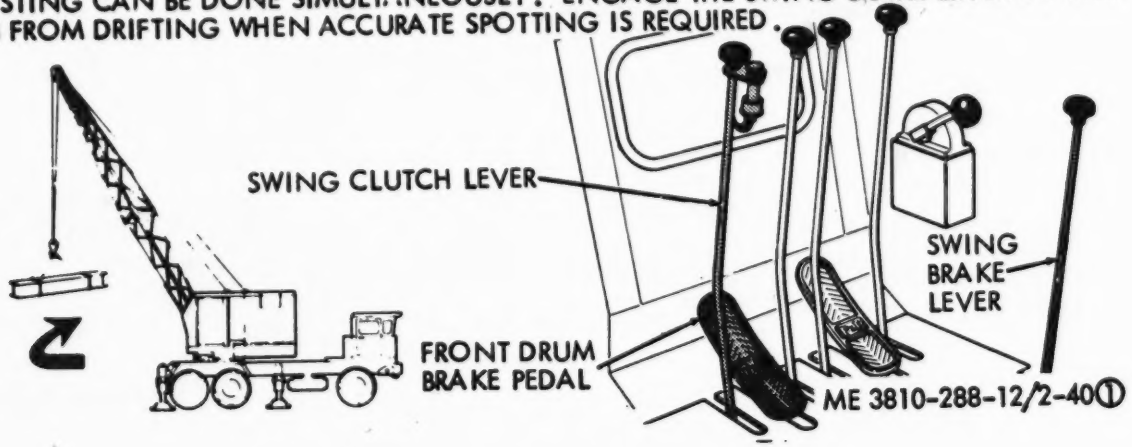
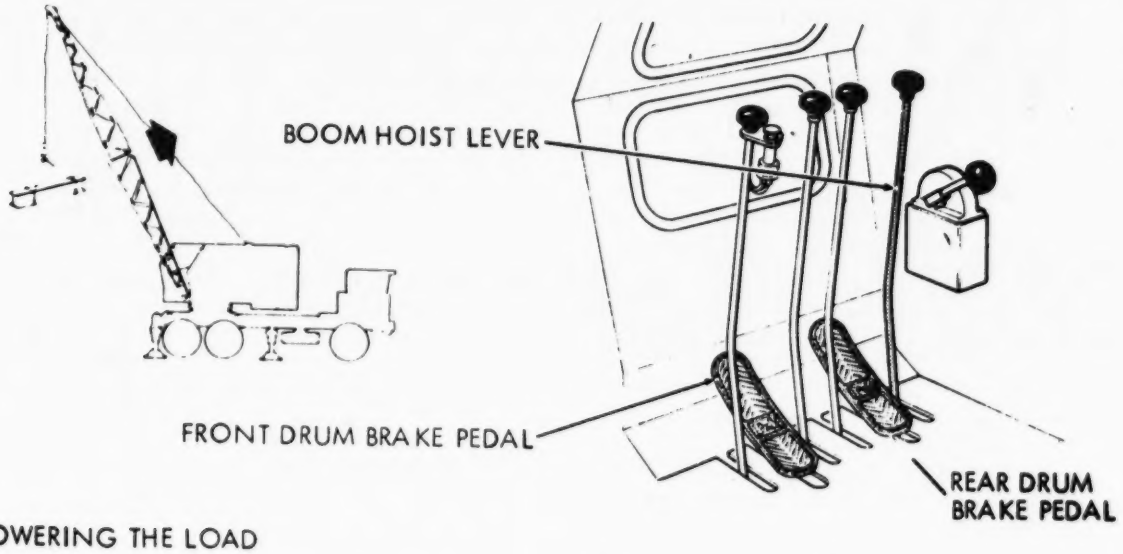


Figure 2-36. Crane operation and control positions (sheet 1 of 2).

SPOTTING THE LOAD

SPOTTING THE LOAD REQUIRES ACCURATE CONTROL OF HOIST AND SWING MOVEMENTS. IT TAKES PRACTICE TO LOCATE THE LOAD AT THE EXACT SPOT WITHOUT HUNTING OR OVERSHOOTING. RAISE OR LOWER THE BOOM WITH THE BOOM HOIST LEVER AS NECESSARY TO MAKE ACCURATE LOCATION OF LOAD. WARNING: NEVER BOOM OUT SO FAR THAT RATED LOAD IS EXCEEDED. SEE RATING PLATE.



LOWERING THE LOAD

THE LOAD CAN BE LOWERED IN TWO WAYS: RELEASE THE REAR DRUM BRAKE AND CONTROL LOWERING OF FREE FALLING LOAD WITH BRAKE AND REAR DRUM LEVER OR LOWER FRONT DRUM LOAD USING FRONT DRUM CLUTCH LEVER AND FRONT DRUM BRAKE PEDAL. THE LOAD WILL AUTOMATICALLY POWER DOWN.

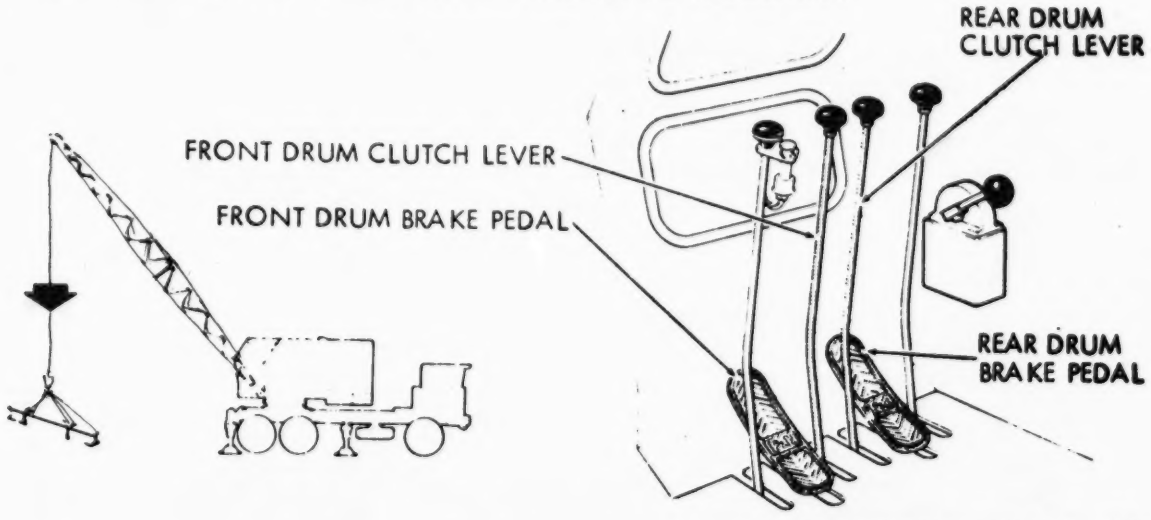


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Figure 2-36. Crane operation and control positions (sheet 2 of 2).

Caution: **Do not attempt to raise the boom by means of the boom hoist lines if the boom tip is below the level of the ground which supports the carrier. The angle of pull on the boom will be such that the boom may collapse before it can be pulled into the operating position.**

2-16. Clamshell Operation

a. General. The model M320T2 truck crane, with the crane boom and a clam bucket installed and reeved for clamshell operation, is used to handle material which is relatively loose or soft and must be accurately dumped at a higher level than would be possible with a shovel attachment. The clamshell attachment is used widely for loading and unloading loose material from ships and open freight cars, and for digging deep pits or shafts where the digging point is accessible only to a vertically operated bucket.

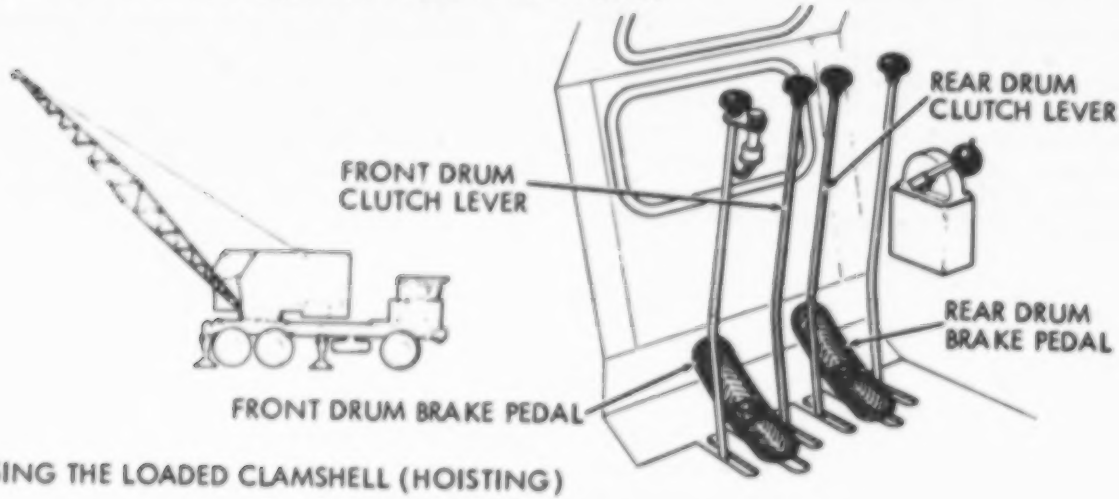
b. Load Limits. Refer to paragraph 1-4 for load limits before starting operation.

c. Positioning the Carrier. Back the carrier to the work site so that most of the work will be performed over the rear of the carrier. Dumping or unloading should be done over the sides of the carrier, if possible. Set the carrier brakes, and extend and set the outriggers (fig. 2-2).

d. Operating Cycle. The clamshell operating cycle consists of four steps; filling the clam bucket (closing); raising the load bucket, swinging and dumping. The boom angle position is set before beginning operations in the same manner as for the crane (fig. 2-36). Start the crane engine (para 2-11) and operate the clamshell as shown on figure 2-37.

FILLING THE CLAMSHELL (CLOSING)

LOWER THE OPENED CLAMSHELL UNTIL IT IS A FOOT ABOVE MATERIAL TO BE WORKED. RELEASE BOTH BRAKE PEDALS SIMULTANEOUSLY AND DROP THE CLAMSHELL. CLOSE CLAMSHELL BY PULLING REAR DRUM CLUTCH LEVER. AT THE SAME TIME CONTROL DIGGING DEPTH OF CLAMSHELL WITH FRONT DRUM CLUTCH LEVER UNTIL IT IS CLOSED AND LOADED. TO DECREASE BITE OF CLAMSHELL, PULL FRONT DRUM CLUTCH LEVER. THIS WILL RAISE THE BUCKET AND DECREASE THE BITE.



RAISING THE LOADED CLAMSHELL (HOISTING)

KEEP THE REAR DRUM CLUTCH LEVER PULLED BACK AND OPERATE THE FRONT DRUM CLUTCH LEVER SO CABLES ARE TAKEN UP AT THE SAME RATE. THE CLOSING CABLE IS THE MOST IMPORTANT AND DOES MOST OF THE WORK. NEVER ALLOW IT TO GO SLACK OR CLAMSHELL WILL IMMEDIATELY SWING OPEN. DO NOT USE HOLDING CABLE TO RAISE THE CLAMSHELL; THE HOLDING CABLE IS USED ONLY TO HOLD THE BUCKET IN POSITION WHEN DUMPING. AS SOON AS BUCKET IS AT DESIRED HEIGHT, APPLY BOTH FRONT AND REAR DRUM BRAKE PEDALS AND AT THE SAME TIME RELEASE BOTH THE FRONT AND REAR DRUM CLUTCH LEVERS.

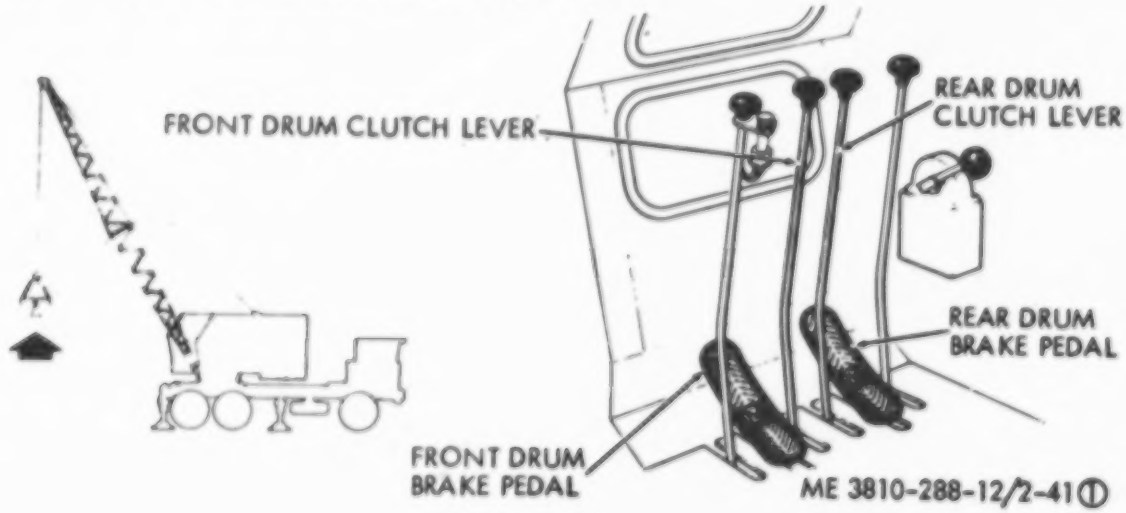
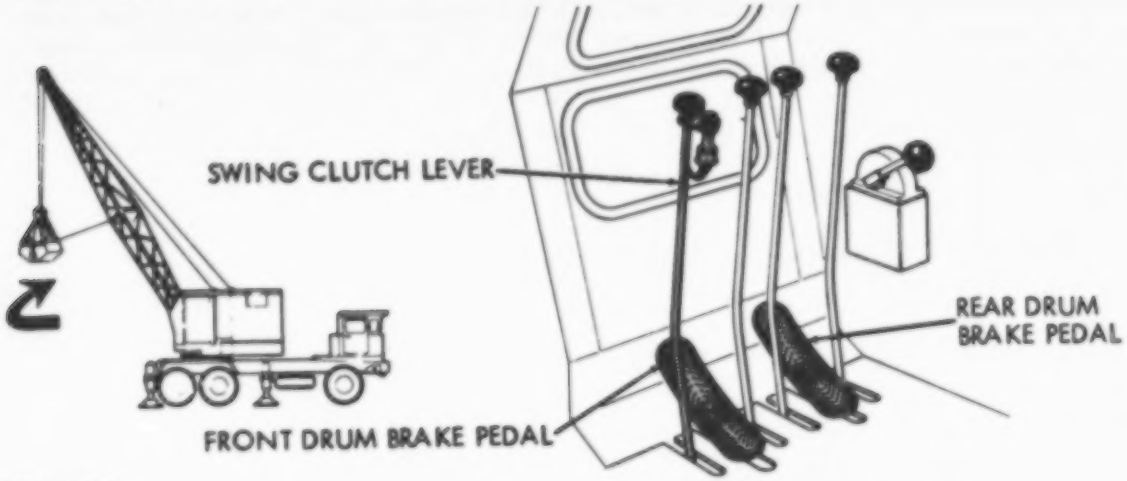


Figure 2-37. Clamshell operation and control positions (sheet 1 of 2).

SWINGING

KEEP BOTH THE FRONT AND REAR DRUM BRAKES ON WHILE SWINGING. PULL SWING CLUTCH LEVER TO SWING TO RIGHT, PUSH TO SWING TO LEFT. ENGAGE SLOWLY SO SWING IS SMOOTH. TO STOP SWING, ENGAGE LEVER IN OPPOSITE SWING POSITION GENTLY. SWINGING AND HOISTING CAN BE DONE SIMULTANEOUSLY AS SOON AS BUCKET IS HIGH ENOUGH TO CLEAR ALL INTERVENING OBSTACLES.



DUMPING

KEEP THE FRONT DRUM BRAKE PEDAL FIRMLY DEPRESSED AND AT THE SAME TIME RELEASE THE REAR DRUM BRAKE PEDAL. DEPRESS THE REAR DRUM BRAKE PEDAL AND STOP THE CABLE BEFORE THE BUCKET HALVES OPEN SO FAR THAT THEY SLAM AGAINST THE STOPS. AFTER CLAMSHELL UNLOADS, SWING THE CRANE WITH CLAMSHELL OPEN BACK TO MATERIAL PILE. WHEN OVER THE WORKING AREA, LOWER THE OPEN BUCKET AND REPEAT THE WORKING CYCLE.

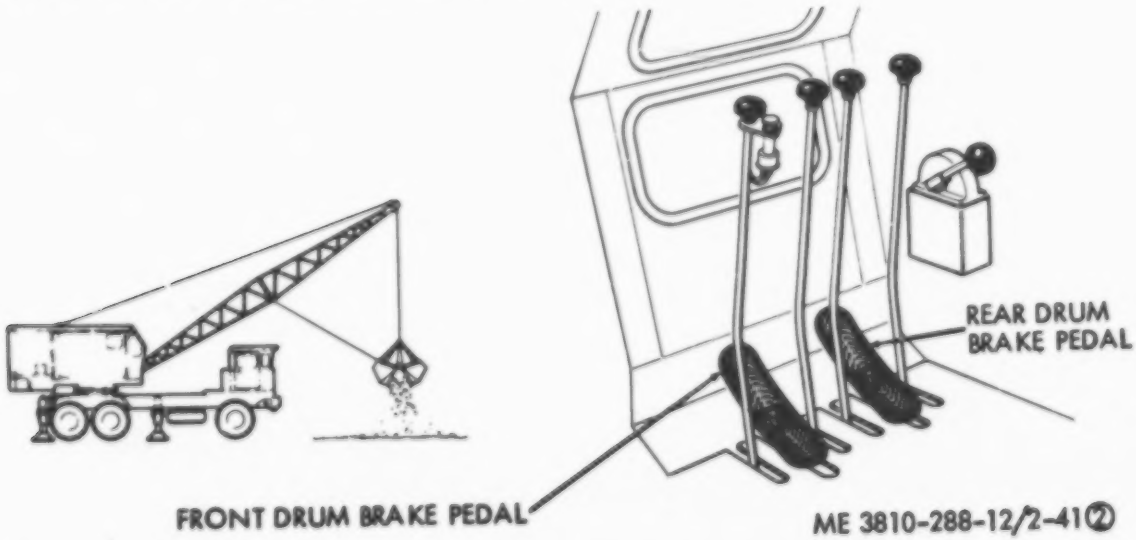


Figure 2-37. Clamshell operation and control positions (sheet 2 of 2).

2-17. Dragline Operation

a. General. The model M320T2 truck crane, with the crane boom and a dragline bucket installed and reeved for dragline operation, is used to handle material which is soft, muddy, sticky, or medium hard, and where the loading and dumping points are far apart, both horizontally, and vertically, where digging is below machine grade and where the material must be dumped accurately. The dragline attachment is used for digging canals, trenches, and levees, making embankments, and skimming of top soil.

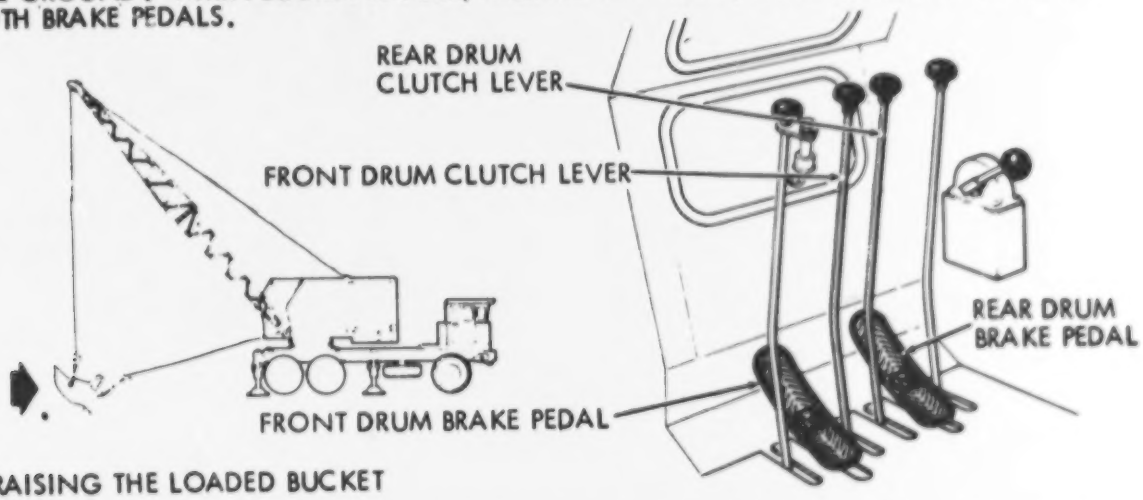
b. Load Limits. Refer to paragraph 1-4 for load limits before starting operation.

c. Positioning the Carrier. Back the carrier to the work site so that most of the work will be performed over the rear of the carrier. Dumping or unloading should be done over the sides of the carrier, if possible. Set the carrier brakes, and extend and set the outriggers (fig. 2-2).

d. Operating Cycle. The dragline operating cycle consists of five steps: casting the bucket, dragging (filling) the bucket, raising the loaded bucket, swinging, and dumping. The boom angle position is set before beginning operations in the same manner as for the crane (fig. 2-36). Start the crane engine (para 2-11), and operate the dragline as shown on figure 2-38.

CASTING AND FILLING THE DRAGLINE BUCKET

CASTING THE BUCKET ADDS 10 TO 20 FEET TO THE EFFECTIVE DIGGING RADIUS. PULL THE FRONT DRUM LEVER AND RAISE THE BUCKET HALF THE DISTANCE BETWEEN THE GROUND AND THE BOOM POINT. DEPRESS REAR DRUM BRAKE AND RELEASE THE LEVER. PULL FRONT DRUM LEVER AND PULL BUCKET IN TOWARD THE BOOM, THEN SIMULTANEOUSLY RELEASE LEVER AND BRAKE PEDAL ALLOWING BUCKET TO CAST OUT BEYOND THE BOOM POINT, ACCURATE CASTING WILL COME ONLY WITH PRACTICE. AFTER THE BUCKET HAS BEEN CAST, PULL THE FRONT DRUM LEVER BACK, DRAGGING THE BUCKET TOWARD THE MACHINE. EASE UP ON THE REAR DRUM BRAKE PEDAL ALLOWING THE HOIST CABLE TO REEL OFF THE DRUM SO THE BUCKET TEETH CONTINUOUSLY BITE INTO THE GROUND. WHEN BUCKET IS FULL, RELEASE THE FRONT DRUM LEVER AND DEPRESS BOTH BRAKE PEDALS.



RAISING THE LOADED BUCKET

PULL THE REAR DRUM LEVER BACK AND RELEASE THE REAR DRUM BRAKE PEDAL. EASE UP ON THE FRONT DRUM BRAKE PEDAL TO HOLD THE BUCKET LEVEL AND PREVENT DUMPING AS THE BUCKET IS RAISED. WHEN BUCKET REACHES DESIRED HEIGHT, APPLY REAR DRUM BRAKE AND RELEASE THE REAR DRUM LEVER. ALSO, APPLY FRONT DRUM BRAKE.

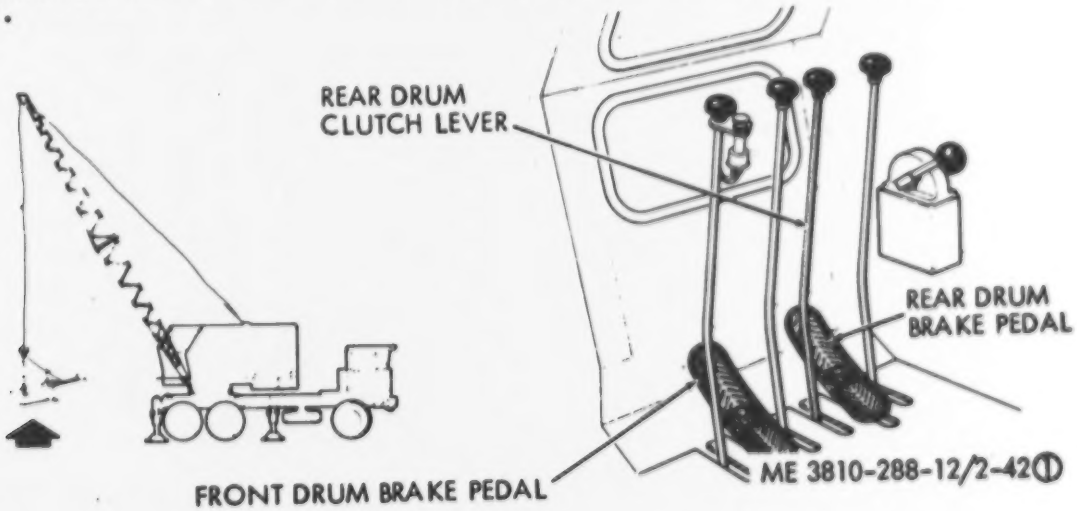
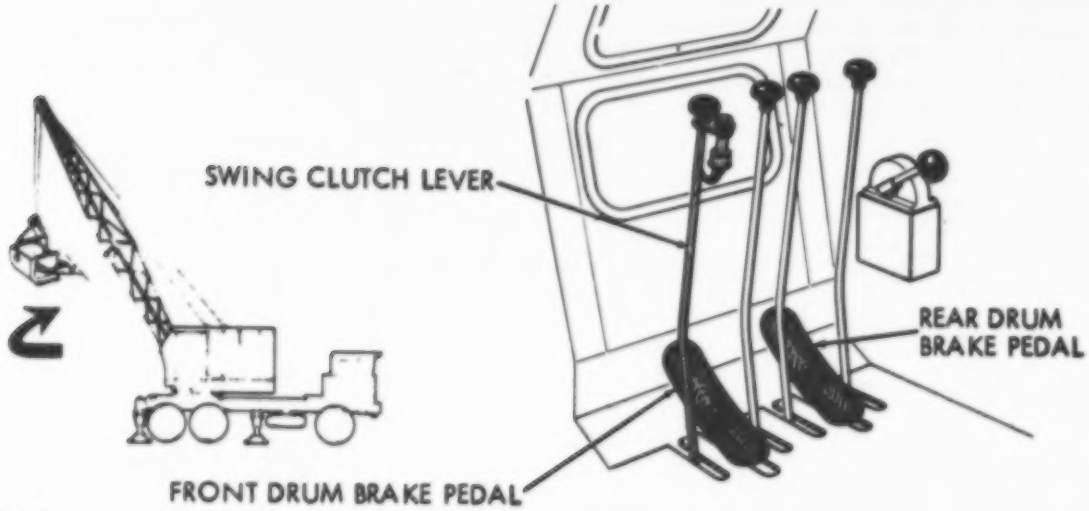


Figure 2-38. Dragline operation and control position (sheet 1 of 2).

SWINGING

KEEP BOTH THE FRONT AND REAR DRUM BRAKES ON WHILE SWINGING. PULL THE SWING CLUTCH LEVER TO SWING TO RIGHT, PUSH TO SWING TO LEFT. ENGAGE SLOWLY SO SWING IS SMOOTH. TO STOP SWING, ENGAGE LEVER IN OPPOSITE SWING POSITION. GENTLY SWING THE BUCKET TOWARD THE DUMP PILE.



DUMPING

AS THE DUMP PILE IS APPROACHED, RELEASE THE FRONT DRUM BRAKE PEDAL ALLOWING THE BUCKET TO SWING OUT AND DUMP ITS LOAD. WHEN THE BUCKET IS DUMPED, APPLY THE FRONT DRUM BRAKE TO KEEP THE CABLE TAUT AND PREVENT UNWINDING. SWING THE BOOM BACK, CAST THE DRAGLINE BUCKET AND REPEAT THE CYCLE.

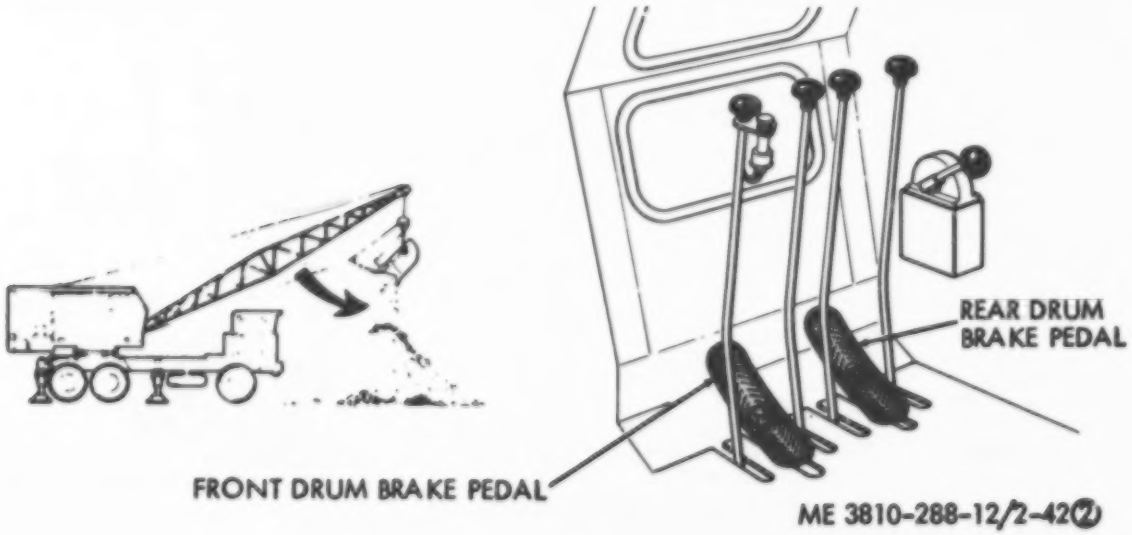


Figure 2-38. Dragline operation and control positions (sheet 2 of 2).

2-18. Piledriver Operation

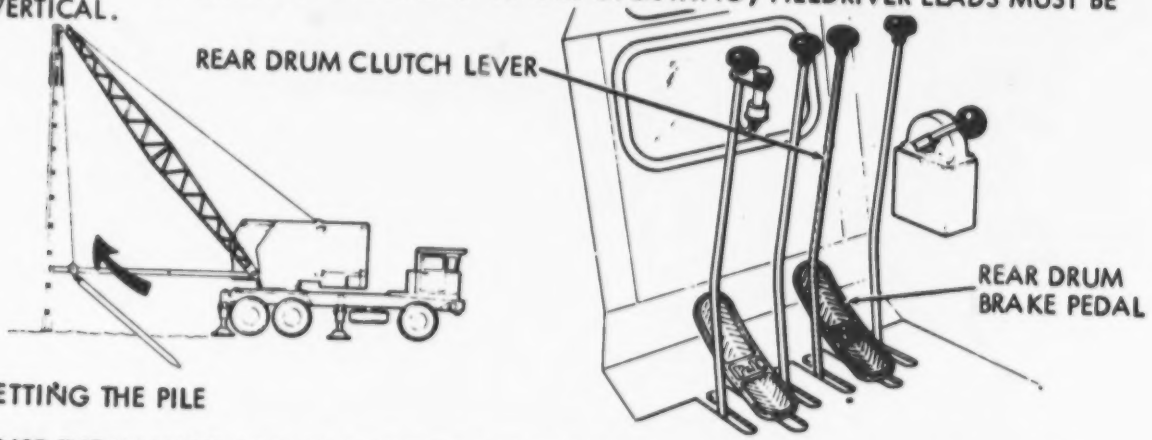
a. General. The model M320T2 truck crane, with the crane boom and a piledriver attachment installed and reeved for piledrive operation, is used for driving piles for bridges, piers, and foundations.

b. Positioning the Carrier. Back the carrier to the work site so that most of the work will be performed over the rear of the carrier. Set the carrier brakes, and extend and set the outriggers (fig. 2-2).

c. Operating Cycle. The piledriver operating cycle consists of four steps: positioning the piledriver, setting the pile, lifting the hammer, and dropping the hammer. Start the crane engine, para 2-11. Operate piledriver as shown on figure 2-39.

POSITIONING THE PILEDRIVER

HOOK THE PILE CAP SLINGS IN THE HAMMER LUGS. PULL THE REAR DRUM LEVER BACK TO RAISE THE HAMMER AND PILE CAP IN THE LEADS. APPLY THE REAR DRUM BRAKE PEDAL AND RELEASE THE REAR DRUM LEVER. MOVE THE CARRIER SLOWLY TO POSITION THE PILEDRIVER. WHEN MOVING WATCH THAT THE LEADS DO NOT BOTTOM ON THE GROUND. MAKE SURE BOOM IS CLEAR OF POWER LINES OR OVERHEAD OBSTRUCTIONS. FOR INCREASED STABILITY KEEP THE HAMMER AND CAP LOW IN THE LEADS WHILE MOVING. POSITION THE PILEDRIVER WITH THE LEADS OFF THE REAR OF THE CARRIER. SET THE LEADS IN FINAL POSITION BY BACKING CARRIER AND SWINGING CRANE LEFT OR RIGHT AS REQUIRED. BEFORE OPERATING, PILEDRIVER LEADS MUST BE VERTICAL.



SETTING THE PILE

RAISE THE HAMMER AND PILE CAP TO THE TOP OF THE LEADS, THEN LOCK THE REAR DRUM BRAKE PEDAL. ATTACH THE PILE HOIST CABLE HOOK (ON THE FRONT DRUM) TO THE TOP OF THE PILE. DRAG THE PILE UP INTO THE LEADS BY PULLING BACK ON THE FRONT DRUM LEVER. WHEN THE PILE IS VERTICAL IN THE LEADS, LOWER THE HAMMER AND CAP, GUIDING THE TOP OF THE PILE INTO THE HOLLOW IN THE BOTTOM OF THE PILE CAP. SET THE POINT OF THE PILE IN PLACE ON THE GROUND AND REST THE HAMMER AND CAP ON TOP OF THE PILE. DROP THE SLING HOLDING THE PILE CAP TO THE HAMMER. BE SURE THE PILE IS VERTICAL. DISCONNECT THE PILE HOIST CABLE. STORE THE CABLE FOR EASY ACCESS. THE PILE WILL BE HELD IN POSITION BY THE PILE CAP.

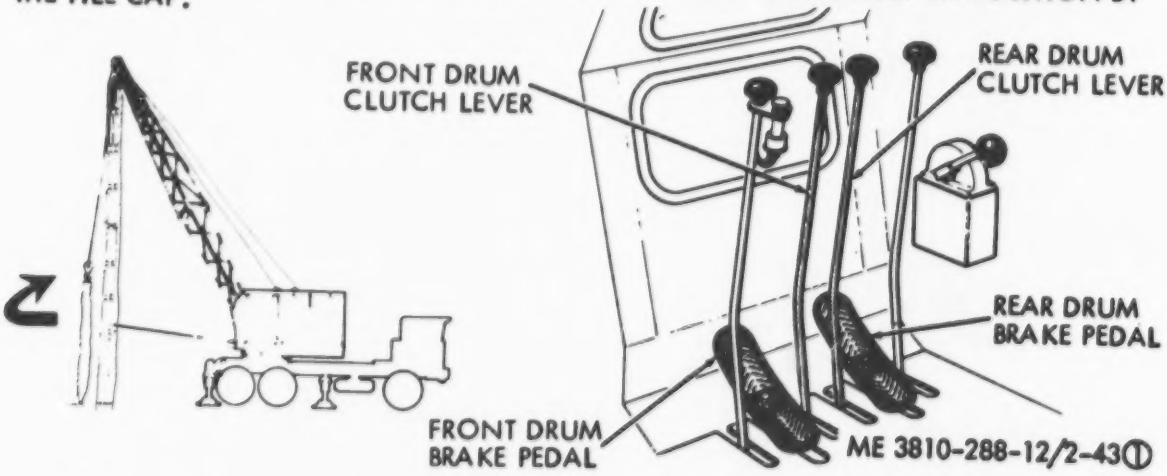
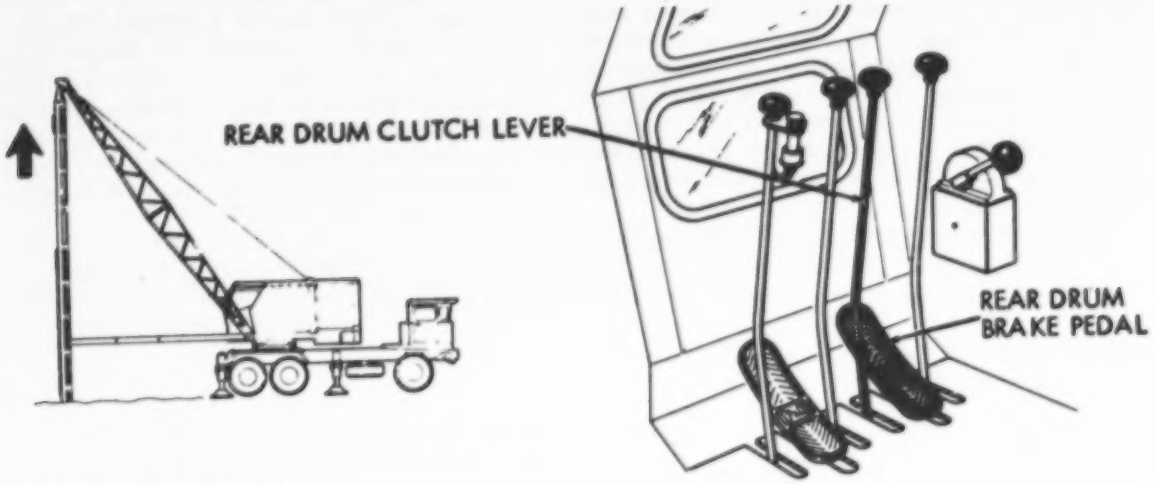


Figure 2-39. Piledriver operation and control positions (sheet 1 of 2)

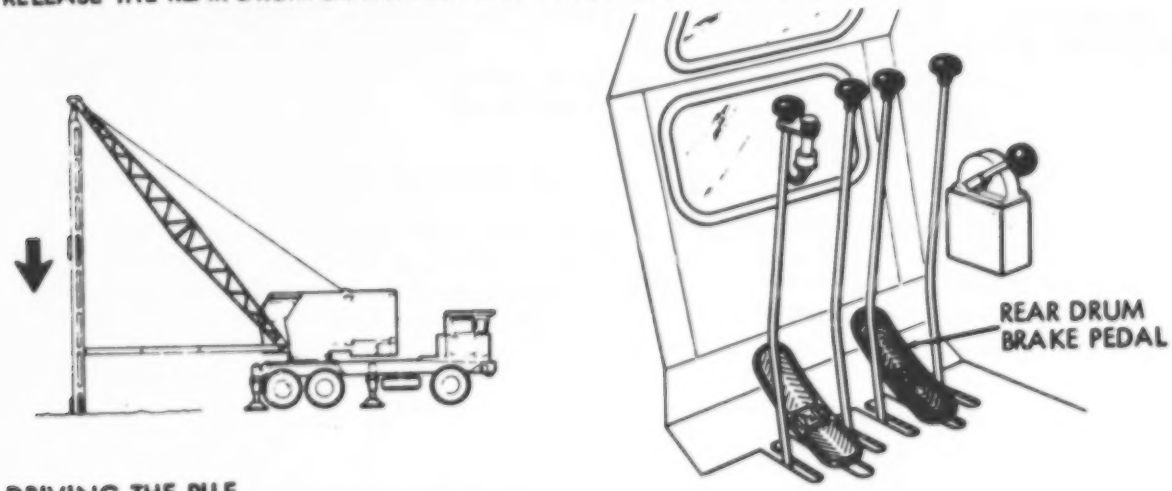
LIFTING THE HAMMER

PULL THE REAR DRUM LEVER BACK TO RAISE THE HAMMER. APPLY THE REAR DRUM BRAKE PEDAL AND RELEASE THE REAR DRUM LEVER WHEN HAMMER REACHES DESIRED HEIGHT.



DROPPING THE HAMMER

RELEASE THE REAR DRUM BRAKE PEDAL TO DROP THE HAMMER.



DRIVING THE PILE

LIFT THE HAMMER A SHORT DISTANCE AND DROP THE HAMMER. JUST AS THE HAMMER REACHES THE WOODEN PILE CAP PLUG, STEP ON THE REAR DRUM BRAKE PEDAL TO KEEP THE HOIST CABLE FROM UNREELING. MAKE THE FIRST SERIES OF BLOWS ON THE PILE LIGHT ONES SO THE PILE WILL BE STARTED INTO THE GROUND EVENLY. CHECK THAT THE PILE IS STRAIGHT. IF THE PILE IS ANGLED, AND NOT TOO DEEP, MOVE THE CRANE TO STRAIGHTEN IT. AFTER THE PILE IS STARTED, RAISE THE HAMMER TO THE TOP OF THE LEADS, DROP IT AND APPLY THE REAR DRUM BRAKE AS INSTRUCTED ABOVE. REPEAT THE ACTION UNTIL THE PILE IS DRIVEN TO THE DESIRED DEPTH. SLING THE PILE CAP TO THE HAMMER, RAISE THE HAMMER, POSITION THE PILEDRIVER OVER THE NEXT PILE SITE, AND REPEAT THE CYCLE.

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Figure 2-39. Piledriver operation and control positions (sheet 2 of 2).

2-19. Backhoe Operation

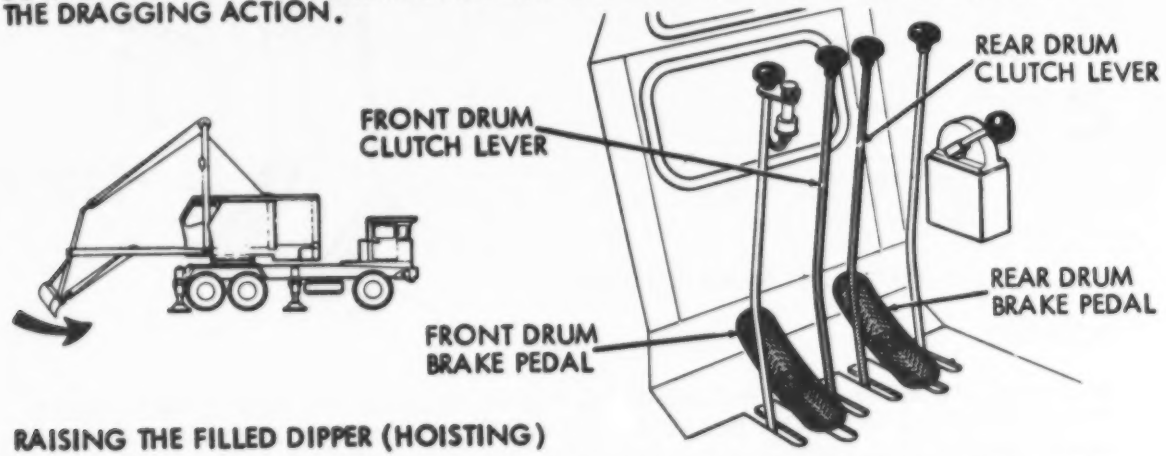
a. General. The model M320T2 truck crane, with the backhoe attachment installed and reeved as described in paragraph 2-8, is used where the digging level is below machine grade, the area to be worked is relatively small, requires the movement of a minimum amount of material, and the material must be dumped accurately. The backhoe attachment is used in preference to the dragline attachment when precise control is required, and when it is required that the walls of the excavation be straight.

b. Positioning the Carrier. Back the carrier to the work site so that most of the work will be performed over the rear of the carrier. Dumping or unloading should be done over the sides of the carrier, if possible. Set the carrier brakes, and extend and set the outriggers (fig. 2-2).

c. Operating Cycle. The backhoe operating cycle consists of four steps; filling the dipper, hoisting, swinging and dumping. During the backhoe operation, tension must be maintained in both the front and rear drum lines at all times, since they are interdependent. Start the crane engine (para 2-11) and operate the dragline as shown on figure 2-40.

FILLING THE BACKHOE DIPPER

PUSH FORWARD ON THE FRONT DRUM LEVER, ALLOWING DRAG CABLE TO PLAY OUT AS THE DIPPER SWINGS OUT. PULL REAR DRUM LEVER TO TAKE UP SLACK IN THE HOIST LINE AND TO PREVENT THE BOOM FROM DROPPING. WHEN THE DIPPER IS EXTENDED FULLY, PUSH THE REAR DRUM LEVER FORWARD AND RELEASE THE REAR DRUM BRAKE PEDAL, GRADUALLY ALLOWING THE BOOM AND DIPPER TO LOWER AND BITE INTO THE GROUND. STEP ON THE REAR DRUM BRAKE PEDAL AND PULL THE FRONT DRUM LEVER BACK TO START DRAGGING THE DIPPER IN TOWARD THE MACHINE. CONTROL THE DEPTH OF THE BITE WITH THE REAR DRUM BRAKE PEDAL. EASING UP ON PEDAL WILL DROP THE DIPPER FOR A BIGGER BITE. HOLDING IT WILL CAUSE DIPPER TO RISE. PRACTICE THE INTERCONTROL OF THE HOIST AND DRAG CABLE BRAKES AND LEVERS TO BECOME FAMILIAR WITH THEIR OPERATION. WHEN THE DIPPER IS FULL, APPLY BOTH BRAKES AND PUSH THE FRONT DRUM LEVER FORWARD (TO NEUTRAL) TO STOP THE DRAGGING ACTION.



RAISING THE FILLED DIPPER (HOISTING)

PULL THE REAR DRUM LEVER BACK AND RELEASE THE REAR DRUM BRAKE PEDAL. AS THE BOOM IS RAISED, EASE UP SLIGHTLY ON THE FRONT DRUM BRAKE PEDAL, BUT KEEP ENOUGH TENSION IN THE DRAG CABLE TO HOLD THE DIPPER LEVEL UNDER THE BOOM. WHEN THE DIPPER IS RAISED HIGH ENOUGH TO CLEAR THE EXCAVATION, PUSH THE REAR DRUM LEVER FORWARD TO NEUTRAL AND SIMULTANEOUSLY DEPRESS THE REAR DRUM BRAKE.

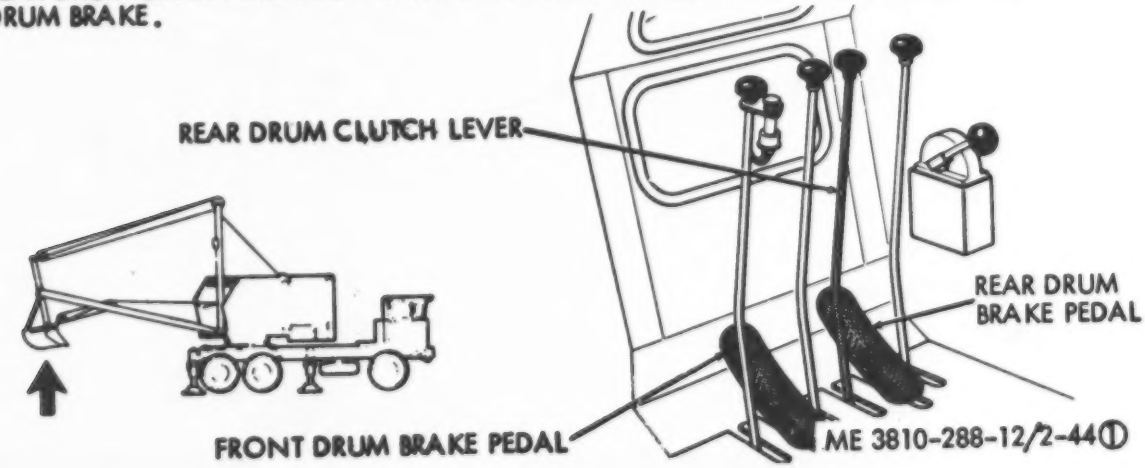
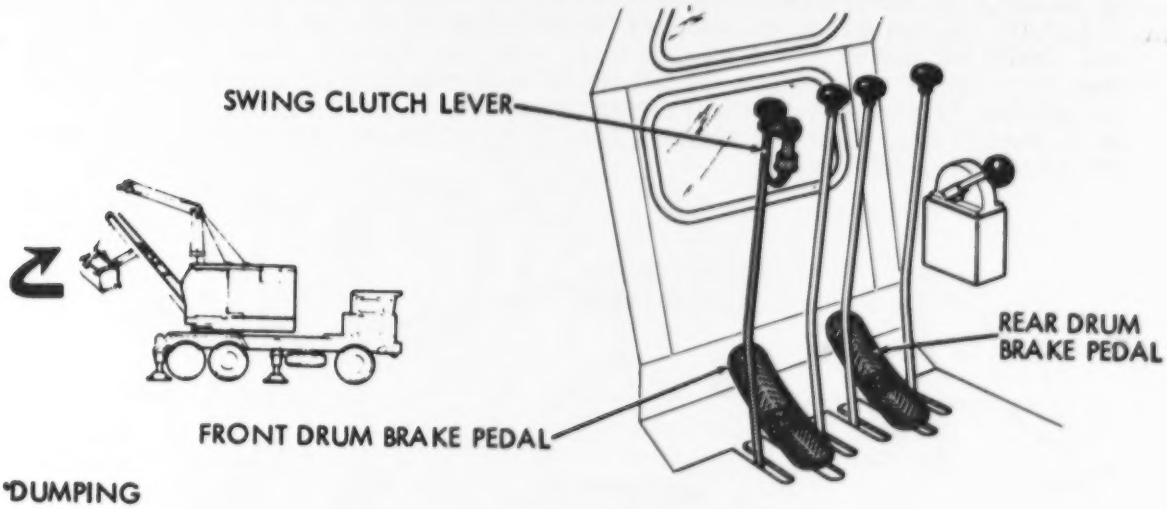


Figure 2-10. Backhoe operation and control positions (sheet 1 of 2).

SWINGING

KEEP BOTH BRAKES APPLIED. PULL SWING CLUTCH LEVER TO SWING TO THE RIGHT. PUSH TO SWING TO THE LEFT. TO STOP SWING, ENGAGE LEVER IN OPPOSITE SWING POSITION. SWING THE BACKHOE DIPPER TO THE DUMPING POINT. WHEN DUMPING INTO TRUCKS, SPOT THE TRUCKS SO THE DIPPER WILL SWING OVER THE TAILGATE OF THE TRUCK. NEVER SWING THE DIPPER OVER THE TRUCK CAB.



DUMPING

WHEN THE DIPPER IS OVER THE DUMPING POINT, RELEASE THE FRONT DRUM BRAKE PEDAL AND PULL BACK ON THE REAR DRUM LEVER, RELEASING THE FRONT DRUM BRAKE PEDAL SIMULTANEOUSLY. THE DIPPER WILL SWING OUT AND UP, THROWING THE MATERIAL FROM THE DIPPER ONTO THE DUMP PILE. WHEN THE DIPPER IS NEARLY EXTENDED FULLY, APPLY BOTH BRAKES AND RELEASE THE FRONT UP ON THE BRAKES UNTIL THE DIPPER IS IN DIGGING POSITION AND REPEAT THE CYCLE.

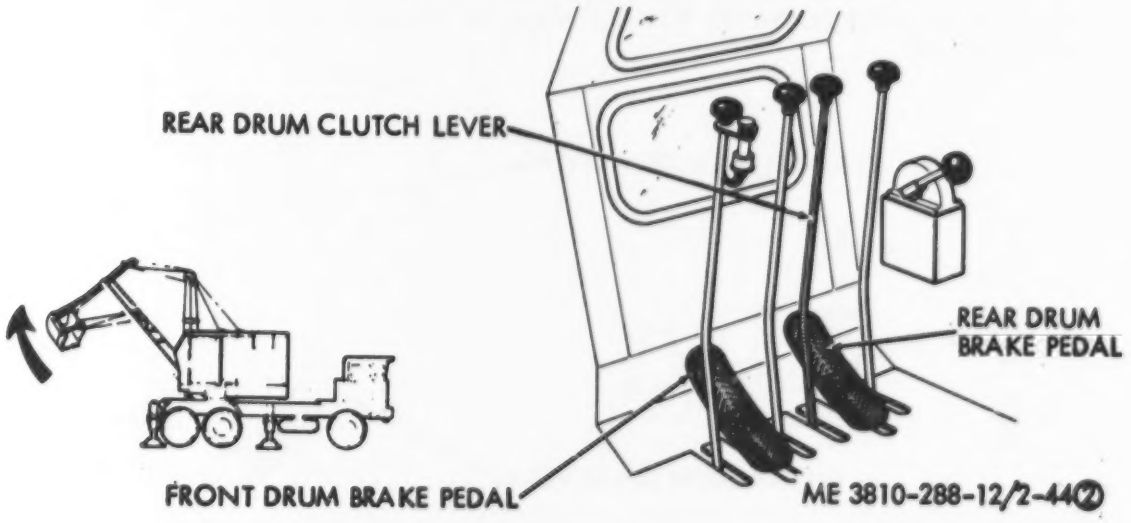


Figure 2-40. Backhoe operation and control positions (sheet 2 of 2).

2-28. Shovel Operation

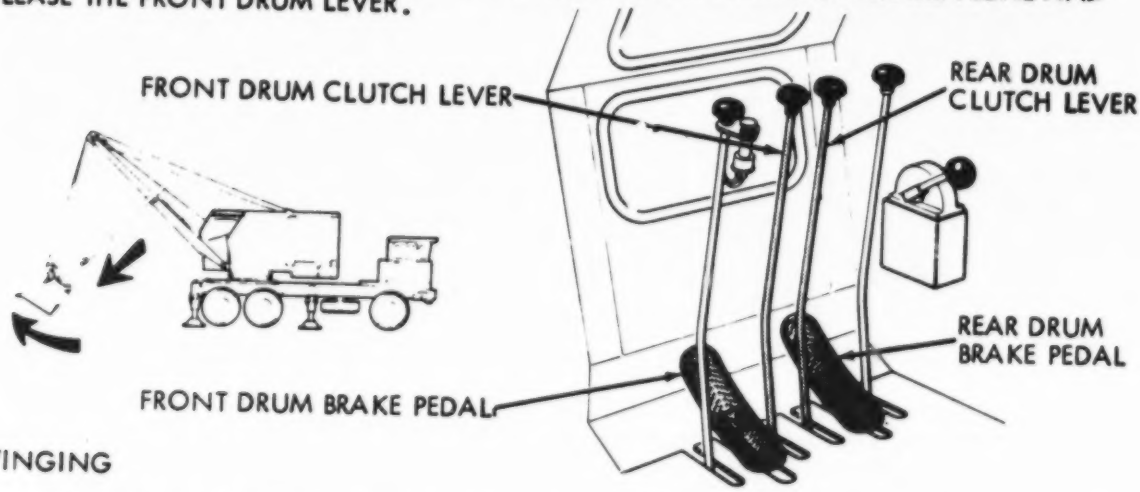
a. General. The model M320T2 truck crane with the shovel attachment installed and reeved as described in paragraph 2-9, is used where the material being dug is firm or hard, the digging and dumping points are not too far apart, accurate dumping is required and the dumping point is at the same level as the machine. The shovel is used most efficiently when the area being worked is large enough to allow operation approaching the maximum working ranges of the shovel attachment.

b. Positioning the Carrier. Back the carrier to the work site so that most of the work will be performed over the rear of the carrier. Dumping or unloading should be done over the sides of the carrier, if possible. Set the carrier brakes, and extend and set the outriggers (fig. 2-2).

c. Operating Cycle. The shovel operating cycle consists of four steps: filling the dipper, swinging, spotting the dump, and dumping. The shovel boom angle position is set before beginning operations in the same manner as for the crane (fig 2-36). Start the crane engine (para 2-11) and operate the shovel as shown on figure 2-41.

FILLING THE DIPPER

FILLING THE DIPPER REQUIRES THE COORDINATION OF HOISTING AND CROWDING THE DIPPER SIMULTANEOUSLY. HOIST THE DIPPER BY PULLING THE REAR DRUM LEVER. AS THE DIPPER STARTS TO RISE, CONTROL THE CROWD MOVEMENT WITH THE FRONT DRUM LEVER. EASING UP ON THE FRONT DRUM BRAKE PEDAL WHEN THE REAR DRUM LEVER IS PULLED BACK WILL ALLOW THE DIPPER TO CROWD INTO THE BANK. WITH THE FRONT DRUM BRAKE APPLIED, THE DIPPER WILL HOIST IN AN ARC THAT WILL DECREASE THE BITE AS THE DIPPER REACHES THE TOP OF THE BANK. WHEN THE DIPPER IS FILLED, APPLY BOTH BRAKES AND RELEASE THE REAR DRUM LEVER. RETRACT THE DIPPER BY PULLING BACK ON THE FRONT DRUM LEVER AND EASING OFF THE FRONT DRUM BRAKE PEDAL. WHEN THE DIPPER IS CLEAR OF THE BANK, APPLY THE FRONT DRUM BRAKE PEDAL AND RELEASE THE FRONT DRUM LEVER.



SWINGING

KEEP BOTH BRAKES APPLIED. PULL CLUTCH LEVER TO SWING TO RIGHT, PUSH TO SWING TO LEFT. TO STOP SWING, ENGAGE LEVER IN OPPOSITE SWING POSITION. SWING THE SHOVEL TOWARD THE DUMPING POINT. (RETRACTING DIPPER AND SWINGING MAY BE ACCOMPLISHED SIMULTANEOUSLY).

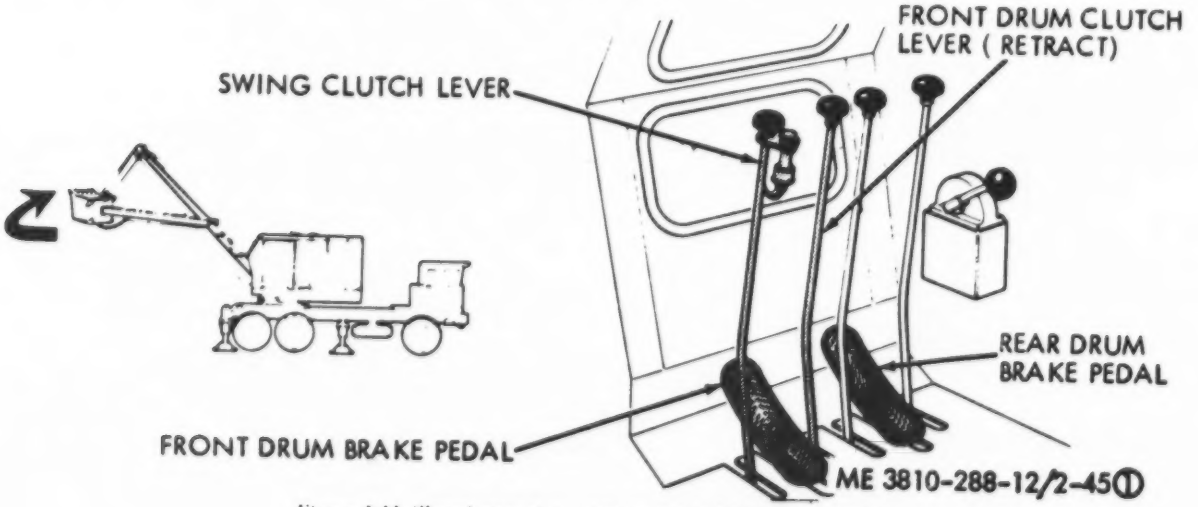
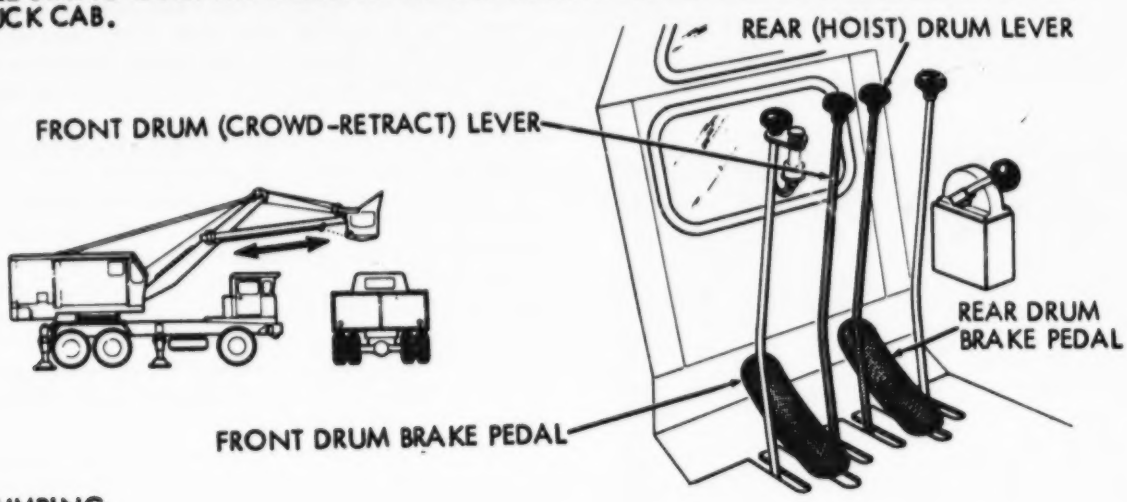


Figure 2-41. Shovel operations and control positions (sheet 1 of 2).

SPOTTING THE DUMP

AS THE LOADED DIPPER IS SWINGING, CROWD OR RETRACT THE DIPPER STICK SO THE DIPPER DOOR WILL BE DIRECTLY OVER THE DUMPING POINT WHEN THE SWING IS COMPLETED. HOIST THE DIPPER, IF NECESSARY, TO RAISE IT TO THE PROPER HEIGHT FOR DUMPING. WHEN DUMPING INTO TRUCKS, SPOT THE TRUCKS SO THE LOAD WILL SWING OVER THE TAILGATE OF THE TRUCK. NEVER SWING THE LOAD OVER THE TRUCK CAB.



DUMPING

AFTER DUMP IS SPOTTED, DEPRESS THE DIPPER TRIP SWITCH ON THE SWING CLUTCH LEVER. HOIST THE DIPPER SLIGHTLY TO RAISE IT CLEAR OF THE FLOWING MATERIAL AND TO OPEN THE DIPPER DOOR COMPLETELY. HOIST HIGH ENOUGH THAT DOOR CLEARS ALL OBSTRUCTIONS. START SWINGING THE EMPTY DIPPER BACK TOWARD THE CUT BEING WORKED. LOWER THE DIPPER BY RELEASING THE REAR DRUM BRAKE PEDAL. THE DIPPER DOOR WILL SNAP SHUT WHEN THE DIPPER IS LOWERED. RETRACT THE DIPPER AND HAVE IT IN POSITION FOR THE NEXT PASS WHEN THE SWING IS COMPLETED. REPEAT THE CYCLE.

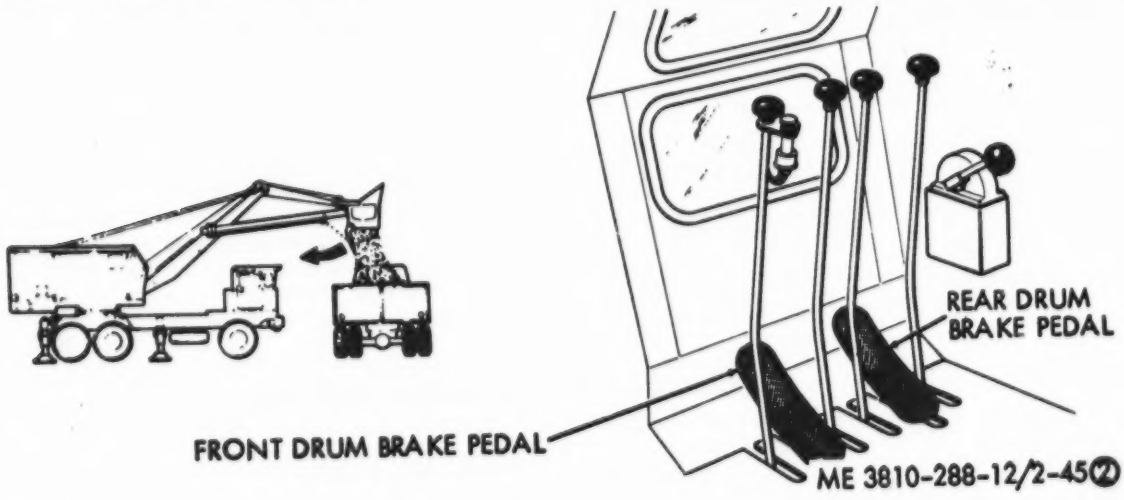


Figure 2-41. Shovel operations and control positions (sheet 2 of 2).

2-21. Movement to a New Worksite

a. Dismantling for Movement.

(1) *General.* The truck crane can be transported readily, as it is mounted on its own carrier. Before moving the equipment, obtain information on road conditions and possible restrictions along the route due to clearances. Secure the crane cab by disengaging all clutches, setting all brakes, and installing the anti-rotation bars that brace the upper to the carrier frame. Refer to figure 2-42.

Figure 2-42. Anti-rotation device installed.

Caution: Do not transport the truck crane with the piledriver front-end attachment installed.

(2) *Transportation without crane boom.*

(a) Lower the boom over the rear of the carrier to the horizontal position, and build up cribbing under the boom as shown in figure 2-4.

(b) Disconnect the boom hoist line dead-end from the gantry frame, and take up the line onto the boom hoist drum.

(c) Remove the hook block, clamshell bucket, or drag bucket, and take up the main and secondary hoist lines onto the rear and front drums.

(d) Remove the boom backstops (fig. 2-7).

(e) Use wedges or a hydraulic jack to relieve the weight of the boom on the boom foot pins, and remove the boom foot pins, (fig. 2-6).

(f) Move the carrier away from the cribbed-up boom. Refer to figure 2-5 and disassemble the boom assembly.

(3) *Transportation with crane, clamshell, or dragline boom.*

(a) Lower the boom to the boom cradle at the front of the carrier.

(b) Take up the slack in the boom hoist line so that the boom is supported by the boom hoist line just above boom cradle. Set the boom hoist drum pawls.

(c) Make certain that the swing lock is set. Refer to figure 2-32. Connect the anti-rotation device rods. See figure 2-42.

(d) Secure the hook block to the underside of the boom and take up the slack in the hoist line.

(e) Be sure outriggers are retracted and pinned in place (fig. 2-3).

(4) Transportation with shovel or backhoe.

(a) Swing the crane, with the dipper extended, until the boom is in line with the boom cradle. Engage the swing lock, and install the anti-rotation device rods (fig. 2-42).

(b) Lower the boom until it is approximately six inches above the boom cradle. Keep the boom hoist cable tight.

(c) Use a length of cable to snub the dipper stick to the carrier towing hooks. Draw this cable as tight as possible. Take slack out of all cables supporting the front end.

Note. For moves over straight, open road, the shovel or backhoe may be moved with the dipper stick and boom over the rear of the carrier. Faced this way, the boom can be quite low and the unit can be moved with speed and safety.

b. Reinstallation after Movement. Refer to paragraph 2-2 for installation instructions after movement to a new work site.

Section II. OPERATION OF AUXILIARY EQUIPMENT

2-22. Fire Extinguisher (Carbon Tetrachloride Type)

a. Description. The dry chemical type fire extinguisher supplied with the truck crane is a 2½ pound hand-operated type. It is suitable for electrical fires because it will not damage electrical equipment or conduct electricity.

b. Operating Procedures. Refer to TB 5-4200-200-10, Hand Portable Fire Extinguishers For Army Users, for proper operating procedures.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

2-23. Operation in Extreme Cold (Below 0° F or —18° C)

a. General. Operation in extreme cold presents special problems due to the increased brittleness of metallic and rubber parts, the danger of freezing, and the increased difficulty of keeping parts lubricated adequately.

Warning: **Personnel should use care to keep from spilling fuel, coolant, or other liquids upon themselves. Exposed parts of the body should not come into contact with metal during cold weather, as serious and painful injury may result.**

b. Lubrication.

(1) Refer to current LO for special lubricants to be used at various temperatures.

(2) When using OES oil in the crankcase, the oil level must be checked frequently, as oil consumption may increase.

c. Cooling System.

(1) Drain and flush the cooling system, to insure proper circulation of coolant throughout the radiator core. Clean the radiator cooling fins, particularly the air passages through the core.

(2) Inspect the cooling system for leaks. Replace worn or damaged hose connections. Tighten the hose clamps.

(3) Fill the cooling system with the proper amount and mixture of antifreeze. Refer to TB 750-651.

(4) After filling the cooling system, run the engine to mix the antifreeze solution thoroughly.

d. Batteries.

(1) Keep the batteries fully charged at all times. The electrolyte in a discharged battery will freeze at a higher temperature than that in a fully charged battery.

(2) If the batteries require water, add only before or during operation, or charge the batteries from an outside source. Charging the batteries will mix the water and the electrolyte, and prevent them from freezing.

(3) Keep the battery terminal connections clean and free from snow or ice accumulations, which may short circuit the batteries externally, causing them to discharge.

(4) In extremely low temperatures, remove the batteries and place them in a heated shelter when not in use. The current output from a warm battery will be higher than that from a cold battery.

e. Fuel System. Keep the fuel tank as full as possible at all times to minimize condensation. If the presence of water is noted in the fuel supply, drain the tank and refill it with clean fuel. Refer to figures 3-2 and 3-3.

f. Starting.

(1) At very low temperatures, provide heat in the cab for as long as possible before attempting to start the engine.

Warning: **Do not use an open flame as the source of heat.**

(2) Crank the engine with the ignition off to free the pistons and bearings.

(3) Lift the choke knob to provide the richest fuel mixture possible. Advance the throttle control to its middle position.

(4) Turn on the ignition switch and start the engine. If the engine does not start, determine whether the fuel line is frozen.

g. Warmup. Cover part of the air passages through the radiator, to aid warmup and to maintain engine running temperature. During warmup only, the entire radiator may be covered.

h. Stopping. Set all dippers, buckets, or loads on blocks to keep them from freezing to the ground, leaving just enough tension in the cables to keep them taut. Set all drum pawls, and release the clutches and brakes. Turn off the engine ignition. Close all cab openings securely.

i. Operation on Snow or Ice. Take all necessary precautions to insure a firm footing for the truck crane. Extend the outriggers (para 2-2) using blocking under the jackfloats to obtain firm footing.

2-24. Operation in Extreme Heat

a. General. Operation in extreme heat presents special problems due to the difficulty in keeping the engine from overheating.

b. Lubrication.

(1) Refer to current LO for lubricants to be used.

(2) Make certain that the engine crankcase oil is at the proper level. An inadequate supply of crankcase oil will prevent proper dissipation of heat from the engine.

c. Cooling System.

(1) Drain and flush the cooling system, to insure proper circulation of coolant throughout the radiator core. Clean the radiator cooling fins, particularly the air passages through the core, of insects, leaves, dirt, and other foreign material that will restrict air flow.

(2) Inspect the cooling system for leaks. Replace worn or damaged hose connections. Tighten the hose clamps.

(3) Keep the water pump fan belt adjusted properly.

(4) If the engine becomes overheated from lack of coolant, let the engine run at a fast idle and add coolant slowly.

(5) If the engine overheats after refilling the

cooling system, shut down the engine and allow it to cool. Drain the cooling system by opening the drain cocks on the radiator and the engine block, and flush out the system. Refill the cooling system with clean water; do not use salt or mineral water solutions in the cooling system.

(6) If the engine continues to overheat in operation, report the condition to organizational maintenance.

d. Batteries. Keep as much air as possible circulating around the batteries. Check the electrolyte level frequently; add distilled water as necessary to keep the electrolyte level ⅜ inch above the plates.

e. Engine Operation. Keep the air intake and exhaust openings clear. Keep the engine clean, and allow air to circulate freely around the engine.

(1) Avoid racing the engine, and avoid operating at full throttle when part throttle will handle the load.

(2) Avoid lugging the engine; keep the engine speed high enough to maintain the fan speed.

(3) Avoid idling the engine unnecessarily; shut the engine down during a lull in the operation.

2-25. Operation in Dusty or Sandy Area

a. General. Operation in dusty or sandy areas presents special problems due to abrasive action of dust which shortens the life of parts. Make every effort to keep dust and sand out of the moving parts of the crane machinery and engine.

b. Lubrication. All lubricants and lubricating equipment must be kept clean. Service breathers and air cleaners frequently to remove sand and dust. Lubricate more frequently to keep a supply of clean lubricant at moving parts. Clean all lubrication fittings thoroughly before attaching the grease gun.

c. Revolving Frame Live Roller Circle. Keep the roller path and rollers clean and dry. Do not lubricate the rollers or the roller path; lubricant on the rollers or roller path will collect sand and cause the rollers to wear excessively.

d. Clutches and Brakes. Inspect the clutch and brake linings frequently. After operation in dust or sand, blow loose grit out of linings. Failure to keep the linings clean will result in worn bands, scored drums, and unsatisfactory operation.

e. Cables. Keep unused cables in boxes. Clean and lubricate operating cables frequently.

f. Fuel System. Keep the fuel tank filler cap tight to prevent sand or dust from entering the fuel tank. Service the fuel filters frequently to keep them free from sand and grit.

g. Footings. Use wood blocking or mats under the outrigger jackfloats when operating in sand. See that the carrier does not shift during operation.

2-26. Operation in High Humidity or Salt Water Area

a. General. Moisture and salt will cause deterioration of paint, cables, wiring, and all exposed metallic parts. Keep parts dry and well lubricated in high humidity or salt water conditions.

b. Wiring. The wiring of the truck crane has been moisture and fungus proofed, but the sheathing can be cracked and split during operation. Frequent inspections are necessary to detect worn spots from developing into short-circuit conditions. Report any such condition to organizational maintenance.

c. Corrosion Prevention. Completely remove rust and corrosion at the first appearance on any part of the truck crane. Wash off salt water and dry all parts thoroughly; paint the exposed surfaces immediately. Place a film of lubricant or grease on all polished or machined metal surfaces and other surfaces which cannot be painted.

d. Lubrication. Keep parts lubricated thoroughly, to repel water from polished metal surfaces and to prevent the entry of water into bearings.

2-27. Operation at High Altitudes

Operation at high altitudes presents special problems due to lower atmospheric pressure and wide temperature ranges. At altitudes above 5,000 feet, it may be necessary to adjust the carburetor (refer this condition to organizational maintenance). Make certain that the air cleaner is clean and free from obstructions.

Caution: Check the engine frequently for overheating in high altitude operation.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION

3-1. Lubrication Order (LO) Requirements

Refer to the current issue of LO 5-3810-294-12 for lubrication information.

3-2. General Lubrication Instructions

a. Storing Lubricants. Keep all lubricants in closed containers and store in a clean, dry place away from external heat. Allow no dust, dirt, or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready to use.

b. Cleaning. Keep all external parts not requiring lubrication clean of lubricants. Before lubricating the equipment, wipe all lubrication points free of dirt and grease. Clean all lubrication points after lubricating to prevent accumulation of foreign matter.

c. OES Oil.

(1) The crankcase oil level must be checked frequently, as oil consumption may increase.

(2) The oil may require changing more frequently than usual because contamination by dilution and sludge formation will increase under cold weather operation conditions.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-3. General

To insure that the model M320T2 truck crane is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

3-4. Preventive Maintenance Table

Refer to Table 3-1 for a listing of preventive maintenance checks and services.

Table 3-1. Preventive Maintenance Checks and Services

B — Before Operation A — After Operation M — Monthly
D — During Operation W — Weekly Q — Quarterly

Item number	Interval: Operator: Daily B	Daily D	Daily A	W	Org. M	Org. Q	Item to be Inspected	Procedure	Reference
	X		X				FUEL SUPPLY	Keep tank full.	Figure 3-2
				X			FUEL FILTER (SEDIMENT BOWL)	Clean as required.	Figure 3-4
	X		X				RADIATOR	Fill to ¼ inch above baffle plate.	Figure 3-5
	X		X				RAIN SHUTTERS	Open before starting engine, close after stopping.	Figure 2-32
				X			BATTERIES	Check electrolyte level and tightness of connections. Fill to ⅜ inch (approx.) above the plates. In freezing weather, run the engine for one hour after adding water.	Figure 3-7
	X						CABLES	Check for signs of wear or damage. Service and replace as necessary.	Paragraph 3-31
	X						FIRE EXTINGUISHER	Check for broken seal and correct weight.	Paragraph 3-42
	X						HYDRAULIC FLUID RESERVOIR	Check level and add fluid if necessary.	Figure 3-9
	X	X	X				FRONT DRUM CLUTCH	Check operation, adjust if necessary.	Paragraph 3-33
	X	X	X				REVERSE SHAFT CLUTCH	Check operation, adjust if necessary.	Paragraph 3-35
	X	X	X				REAR DRUM CLUTCH	Check operation, adjust if necessary.	Paragraph 3-32
	X	X	X				HORIZONTAL SWING SHAFT CLUTCH	Check operation, adjust if necessary.	Paragraph 3-35
	X	X	X				BOOM HOIST CLUTCH	Check operation, adjust if necessary.	Paragraph 3-34
	X	X	X				FRONT DRUM BRAKE	Check operation, adjust if necessary.	Paragraph 3-36
	X	X	X				REAR DRUM BRAKE	Check operation, adjust if necessary.	Paragraph 3-36
	X	X	X				BOOM HOIST BRAKE	Inspect mechanical components and check operation.	Paragraph 3-37
	X	X	X				SWING BRAKE	Check operation, adjust if necessary.	Paragraph 3-38
				X			SHOVEL CROWD CHAIN	Check for proper tension, adjust if necessary. Midspan chain slack should be approximately 1½ inch.	Paragraph 3-27
				X			REVERSING SHAFT CHAIN	Check for proper tension, adjust if necessary. Midspan chain slack should be between ⅛ and ⅜ inch.	Paragraph 3-40
				X			REAR DRUM CHAIN	Check for proper tension, adjust if necessary. Midspan chain slack should be approximately ½ inch.	Paragraph 3-40
				X			HORIZONTAL SWING SHAFT CHAIN	Check for proper tension, adjust if necessary. Midspan chain slack should be approximately ½ inch.	Paragraph 3-40
	X		X				CONTROLS	With the unit running, operate each control. Insure that the controls function properly.	Figure 2-32
	X						BOOM AND/OR JIB	Visually inspect for damage such as cracks or breaks.	Figure 3-16
	X						SHEAVES AND HOOK BLOCK	Visually inspect for damage such as cracks or breaks.	Figure 3-15

Table 3-1. Preventive Maintenance Checks and Services — Continued

B — Before Operation A — After Operation M — Monthly
D — During Operation W — Weekly Q — Quarterly

Item number	Interval: Operator: Daily: B	Interval: Operator: Daily: D	Interval: Operator: Daily: A	Interval: Operator: W	Interval: Org.: M	Interval: Org.: Q	Item to be Inspected	Procedure	Reference
							SHEAVES AND HOOK BLOCK (Continued)	Replace hook block if cracked or if there is a 15% increase in the distance from the hook point to the internal surface of the hook throat (compare with a new hook block for distance). Replace worn, cracked or distorted sheaves.	
							GAUGES	Check for the following normal readings: Coolant Temperature — 160° F to 200°F Engine oil pressure — 45 psi maximum. Tachometer — 1980 (±25) rpm Voltmeter *Note:* During operation, check controls and gauges for proper operation. Be alert for unusual noises and/or vibration.	Figure 2-34

Section III. TROUBLESHOOTING

3-5. General

This section provides information for diagnosing and correcting unsatisfactory operation or failure of the crane portion of the model M320T2 truck crane. Included in this section is a troubleshooting procedure and procedures for field expedient repairs.

3-6. Troubleshooting

Malfunctions that may occur are listed in table 3-2. Each malfunction listed is followed by a test or inspection and the recommended corrective action.

Note. Malfunctions which are not included in this table will be reported to your supervisor.

Table 3-2. TROUBLESHOOTING

1. (MALFUNCTION) ENGINE WILL NOT CRANK OR START.

Step 1. (Test) Check for corroded battery cables and / or terminals. Check for loose battery cables.
(Corrective Action) Clean cables and / or terminals.
Tighten cables.
Step 2. (Test) Check fuel level.
(Corrective Action) Fill fuel tank.
Step 3. (Test) Check air cleaner for restricted air intake.
(Corrective Action) Service air cleaner.
Step 4. (Test) Check the distributor cap to see if the interior is wet.
(Corrective Action) Dry interior of the distributor cap.

2. (MALFUNCTION) ENGINE OVERHEATS.

Step 1. (Test) Check that rain shutters are open.
(Corrective Action) Open rain shutters.
Step 2. (Test) Check radiator coolant level.
(Corrective Action) Add coolant.
Step 3. (Test) Check for loose radiator hose connections.
(Corrective Action) Tighten any loose connections.
Step 4. (Test) Check engine oil level.
(Corrective Action) Add oil.

3. (MALFUNCTION) BATTERIES DISCHARGE WITH ENGINE RUNNING.

Step 1. (Test) Inspect wiring and check for loose connections.
(Corrective Action) Tighten loose connections.

4. (MALFUNCTION) LOW OIL PRESSURE.

Step 1. (Test) Check oil level.
(Corrective Action) Add oil.

5. (MALFUNCTION) LIGHTS FAIL OR ARE DIM.

Step 1. (Test) Check for loose connections.
(Corrective Action) Tighten loose connections.
Step 2. (Test) Check for dirty lens.
(Corrective Action) Clean lens.

6. (MALFUNCTION) REVOLVING FRAME WILL NOT SWING.

Step 1. (Test) Check swing clutch adjustment.
(Corrective Action) Adjust swing clutch.
Step 2. (Test) Check to see if swing brake is engaged.
(Corrective Action) Disengage swing brake.
Step 3. (Test) Check to see if swing lock is engaged.
(Corrective Action) Disengage swing lock.

7. (MALFUNCTION) CRANE WILL NOT LIFT RATED CAPACITY.

Ste 1. (Test) Check front or rear drum clutches for slippage.
(Corrective Action) Adjust front and / or rear drum clutches.

8. (MALFUNCTION) BOOM WILL NOT RAISE.

Step 1. (Test) Check to see if boom is already in highest position.
(Corrective Action) Lower boom.
Step 2. (Test) Check boom hoist clutch for slippage.
(Corrective Action) Adjust boom hoist clutch.

Table 3-2. TROUBLESHOOTING—Continued

9. (MALFUNCTION) BOOM WILL NOT LOWER.

Step 1. (Test) Check to see if safety pawl is engaged.
(Corrective Action) Lift boom slightly, disengage safety pawl and lower boom.

10. (MALFUNCTION) HARD LEVER OR PEDAL OPERATION. EXCESSIVE LEVER OR PEDAL PLAY.

Step 1. (Test) Check for correct adjustment.
(Corrective Action) Adjust levers and / or pedals.
Step 2. (Test) Check for lack of lubrication.
(Corrective Action) Lubricate levers and / or pedals.

11. (MALFUNCTION) CLAMSHELL OPERATES ERRATICALLY.

Step 1. (Test) Check to see if rear drum brake is dragging.
(Corrective Action) Adjust rear drum brake.
Step 2. (Test) Check to see if front and rear drum clutches are slipping or grabbing.
(Corrective Action) Adjust front and / or rear drum clutches.
Step 3. (Test) Check for proper lubrication of bucket hinges.
(Corrective Action) Lubricate bucket hinges.

12. (MALFUNCTION) DRAGLINE NOT OPERATING PROPERLY.

Step 1. (Test) Check dump cable for proper adjustment.
(Corrective Action) Shorten or lengthen dump cable for proper operation.
Step 2. (Test) Check front or rear drum brakes for proper adjustment.
(Corrective Action) Adjust front and / or rear drum brakes.
Step 3. (Test) Check to see if fairlead rollers or sheaves are sticking.
(Corrective Action) Lubricate fairlead rollers and / or sheaves.

13. (MALFUNCTION) SHOVEL NOT OPERATING PROPERLY.

Step 1. (Test) Check that dipper pitch brace is properly adjusted for material being moved.
(Corrective Action) Adjust dipper pitch brace.
Step 2. (Test) Check to see that front and rear drum brake are properly adjusted.
(Corrective Action) Adjust front and / or rear drum brakes.

14. (MALFUNCTION) BACKHOE NOT OPERATING PROPERLY.

Step 1. (Test) Check for correct dipper pitch.
(Corrective Action) Adjust dipper pitch.
Step 2. (Test) Check that cable is in sheave.
(Corrective Action) Place cable in sheave.
Step 3. (Test) Check front and rear drum brakes for proper adjustment.
(Corrective Action) Adjust front and / or rear drum brakes.

15. (MALFUNCTION) PILE DRIVER NOT OPERATING PROPERLY.

Step 1. (Test) Check to see if hammer is binding on pile leads.
(Corrective Action) Lubricate the hammer.
Step 2. (Test) Check front and rear drum brakes for slippage.
(Corrective Action) Adjust front and / or rear drum brakes.

16. (MALFUNCTION) ENGINE LACKS POWER.

Step 1. (Test) Check to see if fuel filter (sediment bowl) is clogged.
(Corrective Action) Service fuel filter (sediment bowl).
Step 2. (Test) Check to see if air cleaner is clogged.
(Corrective Action) Service air cleaner.

3-7. Field Expedient Repairs

Operating difficulties may occur in the field at a time when it is imperative that the machine be continued in service and when repair parts or supplies are not available for normal corrective action. These expedient repairs (table 3-3) may be used during such emergencies, upon authorization of the unit commander. Equipment so repaired must be removed from operation as soon as possible, and properly repaired before being returned to operation.

Table 3-3. FIELD EXPEDIENT REPAIRS

1. Engine will not crank.	*a.* Batteries dead.	*a.* Use jumper cables from the batteries of another piece of equipment which operates off a 24 volt system and start machine. Be sure to connect the plust (+) terminal to the (+) terminal and the minus (—) terminal to the (—) terminal. Caution: Never connect (+) to (—).
2. Engine overheats	*b.* Terminals or cables corroded. Low fluid level in radiator due to leaks.	*b.* Clean terminals and / or cables. Tape leaky hose or use a commercial "stop-leak" compound in the radiator.
3. Fuel, oil, or other fluid leaks.	Lines cracked or perforated.	Tape leaking area of line until defective line can be replaced.
4. Engine will not start.	*a.* Fuel sediment bowl completely clogged.	*a.* Remove sediment bowl and blow out lines and bowl with compressed air.
	b. Air cleaner so clogged it cannot be cleaned.	*b.* Remove air cleaner output hose and operate without air cleaner.
5. Engine overheats and oil temperature is too high.	Engine oil filter elements clogged.	Remove filter elements and operate without.

Section IV. MAINTENANCE INSTRUCTIONS

3-8. General

The maintenance operations described in this section are those allocated to the operator / crew by the maintenance allocation chart (MAC). Maintenance functions are presented in the same groupings as listed in the MAC. For example; all fuel system checks are grouped, all electrical system checks are grouped, etc.

3-9. Air Cleaner Service

Refer to figure 3-1 and service the air cleaner.

Figure 3-1. Air cleaner service.

3-10. Fuel Tank Service

The fuel tank should be kept as full as possible at all times, to minimize condensation. Keep the fuel tank filler cap tight to prevent the entry of foreign material into the tank. Refer to figure 3-2. If water or other contamination is detected in the gasoline, refer to figure 3-3, and drain the tank at the tank drain beneath the revolving frame.

Warning: **When refueling the model M320T2 truck crane, always provide a metal to metal contact between the filler nozzle and the gasoline tank. This will prevent sparks which might ignite fuel, and will thus prevent an unsafe condition which might destroy the machine or injure personnel.**

Figure 3-2. Fuel tank filler cap.

Figure 3-3. Fuel tank drain plug.

3-11. Fuel Filter (Sediment Bowl) Service

Refer to figure 3-4 and service the fuel filter (sediment bowl).

Figure 3-4. Fuel filter (sediment bowl) service.

3-12. Throttle Control Service

Check that the throttle control (5, fig. 2-32) is easily movable through approximately a 100° arc (50° on either side of the vertical position).

3-13. Choke Control Service

Inspect the choke control (25, fig. 2-32) fittings to insure that all fittings are tight.

3-14. Muffler and Pipe Inspection

Inspect the muffler and exhaust pipes for cracks, breaks, or signs of deterioration.

3-15. Radiator Service

a. Refer to figure 3-5, and service the radiator. Add clean water to bring the level to ¾ inch above the baffle plate, if necessary.

Caution: Turn radiator cap slowly and allow pressure to escape before removing it.

b. Refer to TB 750-651 for instruction concerning amount of antifreeze for cold weather operation.

RADIATOR CAP
CAP COVER
STEP 1. LIFT CAP COVER.
STEP 2. REMOVE RADIATOR CAP.
STEP 3. FILL TO ¾ INCH ABOVE BAFFLE PLATE.
STEP 4. REPLACE RADIATOR CAP.
STEP 5. RETURN CAP COVER TO ORIGINAL POSITION.

Figure 3-5. Radiator service.

3-16. Distributor Service

Service is not normally necessary for the distributor assembly. However, if the engine should fail to start, or if the distributor has become wet, remove the cover illustrated in figure 3-6 and dry the interior of the distributor cap and the points with a clean dry lint-free cloth. Inspect the distributor cover for cracks or damage. Inspect the rotor for cracks or damage. Inspect the points for excessive pitting or corrosion. Report deficiencies to organizational maintenance.

Figure 3-6. Distributor service.

3-17. Engine Control Panel Inspection

Inspect the engine control panel, panel wiring and switches for damage or loose hardware.

3-18. Panel Gage Inspection

Inspect panel gages for any obvious damage. During operation, monitor gages for proper operation.

3-19. Inspection of Lights

Refer to the crane controls illustration, figure 2-32, and to the carrier controls illustration, figure 5-1. Turn on each internal cab light and external light, in turn, and check for correct operation. Check headlights in both the bright and dim conditions. Check directional signals in both directions. Check the operation of the two reel-mounted lights, one in each cab. Be sure dome and dash board lights operate. See that floodlights are adjusted so as to provide adequate lighting around the entire working area. Report any deficiencies to organizational maintenance.

3-20. Inspection of Horns

Depress the crane horn button (fig. 2-32) and the carrier horn (fig. 5-1) and see that the horns operate properly. Check visible wiring to horn buttons for worn or frayed insulation. Report deficiencies to organizational maintenance.

3-21. Battery Inspection and Service

a. Inspect. Refer to figure 3-7, and inspect batteries for cracks, leaks, or other damage. Inspect cables for frayed insulation, broken wires, bent or broken lugs, or corroded terminal lugs. Clean terminals and cable lugs of all corrosion and lubricate terminals and lugs with a light coating of grease as specified in the current LO. Inspect the battery box for cracks, breaks, corrosion, or other damage.

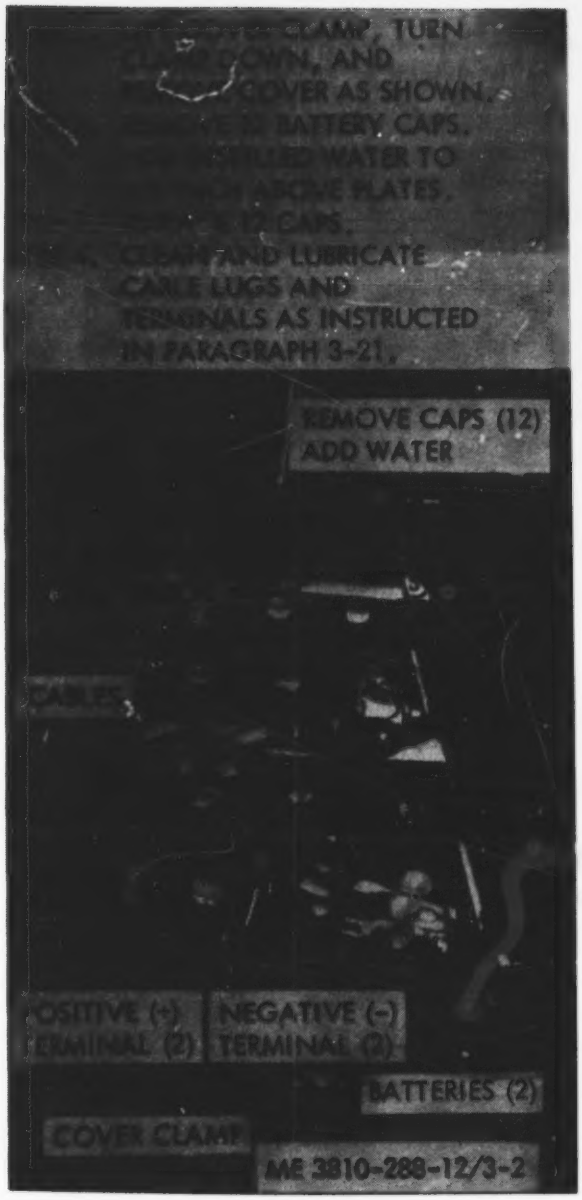


Figure 3-7. Battery inspection and service.

b. Service. Remove twelve caps and add distilled water as required to bring the electrolyte level to approximately ⅜ inch above battery plates. In freezing weather, run the engine for at least one hour after adding water. Keep the batteries charged at all times.

3-22. Inspection of Hull Wiring Harness Conduit

Check all visible wiring for signs of damage or deterioration. Check for loose connections.

3-23. Transmission Inspection and Service

a. Inspect. Refer to figure 3-8 and inspect the transmission breather cap for cleanliness. If necessary, rinse the cap in clean diesel fuel or kerosene and allow to drain dry before replacing. Inspect the transmission for signs of oil leaks or other damage.

b. Service. Refer to figure 3-8 and service the transmission.

Figure 3-8. Transmission inspection and service.

3-24. Inspection of Cab Assembly Glass

Inspect glass in cab assembly for any breakage. Check rubber weatherstripping for signs of deterioration.

3-25. Hydraulic System Inspection and Test

a. Inspect. Refer to figure 3-9 and inspect the hydraulic fluid reservoir to be sure it is filled to the level mark. Add oil if necessary (refer to current LO). Visually inspect all hydraulic lines, fittings, cylinders for leaks, since leaks in these areas could cause hydraulic fluid to touch brake or clutch linings, thus causing the brake or clutch affected to slip. Tighten any loose connections. Report any other deficiencies to organizational maintenance.

b. Test. Refer to the rating plate, figure 1-8, and determine maximum rated load for the length of crane boom installed. Start the crane. See paragraph 2-13. Using a load approximately equal to maximum rated load for the conditions under which the crane is being operated, lift the load a few inches above the ground. See that clutches are adjusted and operating correctly so that the load is lifted smoothly. Apply the appropriate drum brake and see that the brake will hold the load suspended. Lift and lower the boom, being careful not to exceed rating plate maximum loads which so doing. Test all hydraulically operated controls to be sure that they perform normally.

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Figure 3-9. Hydraulic system inspection.

3-26. Tachometer Inspection

With the engine running, check tachometer reading. At low idle, the reading should be about 500 rpm (revolutions per minute). At governed speed (high idle) the reading may be as high as 2,800 rpm. Under full load, the reading should be about 1980 (± 25) rpm. Report any major deviations to organizational maintenance.

3-27. Shovel Front Attachment Maintenance

a. Service. The shovel front must be lubricated at the periodic intervals listed in the current LO. When removed from the machine, all exposed finished surfaces must also be lubricated as often as required to prevent damage due to rust and corrosion. If possible, the entire attachment should be placed inside a suitable dry building, preferably on wooden blocking. The shovel front should be cleaned using an approved cleaning solution.

b. Adjust. Each of the following adjustments must be checked after every 40 hours of shovel operation. Adjust only if necessary.

(1) *Saddle block adjustment.* Shims and wear plates are used to adjust the clearance between the dipper stick and the saddle block wear plates as shown in figure 3-10. The desired minimum clearances between wear plates and saddle blocks are 1 / 64 inch at each location. Adjustment is mandatory when clearance reaches 1 / 16 inch at any point illustrated. Use the following procedure for adjustment:

(a) Support the dipper stick in a horizontal position, using the hoist line.

(b) Divide the dipper stick into three approximately equal lengths, using chalk marks or paint.

(c) Move the dipper stick back and forth a few times to make sure it is free in the saddle blocks and in its normal operating condition.

(d) Position the dipper stick so that the outer third of the dipper stick, as measured by the chalk or paint marks, is located in the saddle block. Measure the clearance between the wear plates on each side of the dipper stick and the dipper stick. Record the clearance measured.

(e) Measure the clearance between the top of the dipper stick and the wear plate at each end of the saddle block and record this measured clearance.

(f) Repeat steps (d) and (e) above for each of the other two marked sections of the dipper stick, each time recording the measurements.

(g) Loosen wear plate bolts and insert shims beneath the wear plates until the clearance between the dipper stick and the wear plates is approximately 1 / 64 inch, at the thickest point of the dipper stick. Adjust both top and side clearances in this manner. Shims are slotted so that they may be tapped into place without removing the wear plates.

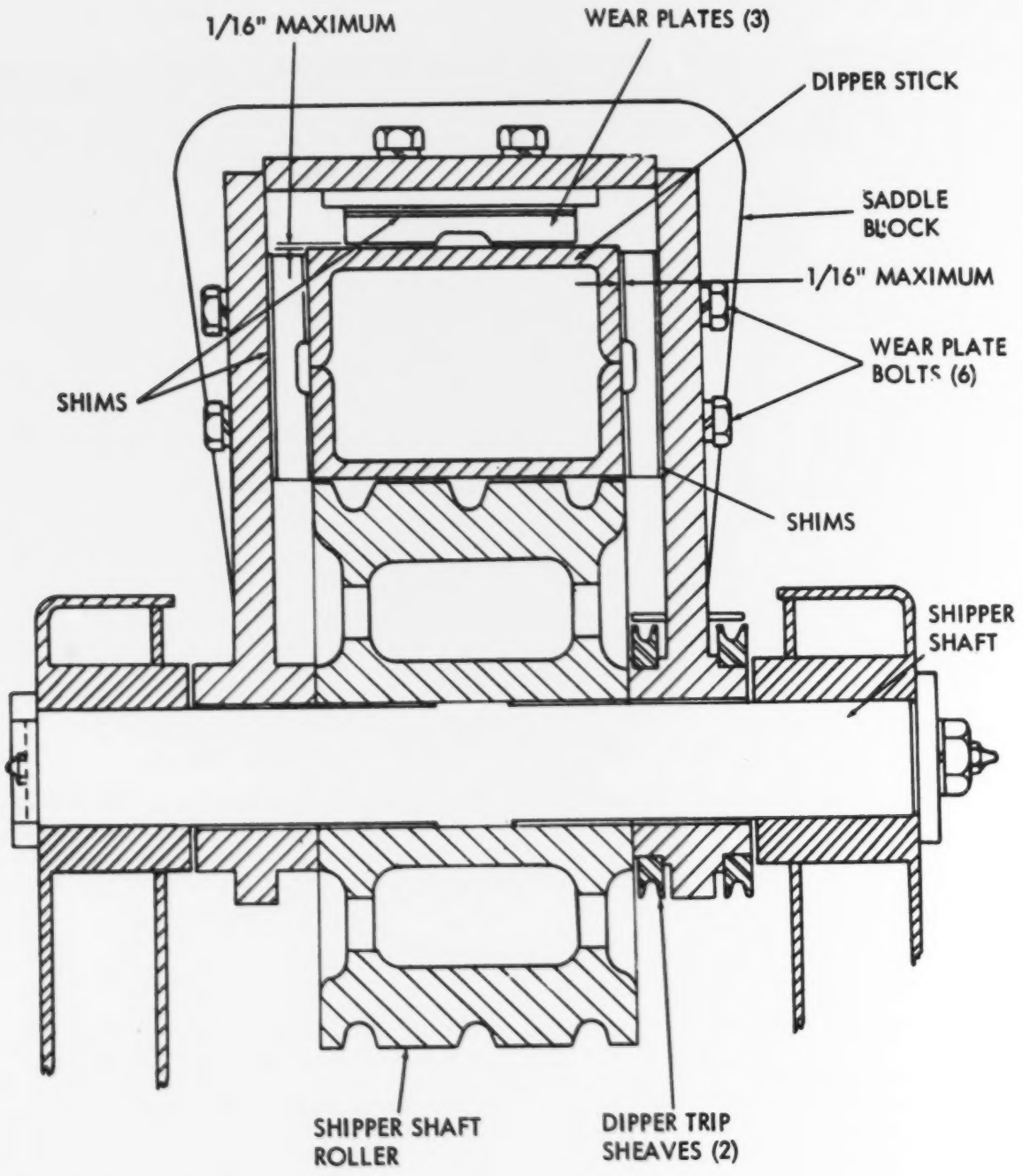

Figure 3-10. Adjusting saddle block.

(2) *Crowd chain adjustment.* Adjust for crowd chain wear as illustrated in figure 2-25. Total midspan chain slack at the top of the chain must be maintained at approximately 1⅛ inch.

(3) *Rake angle adjustment.* Refer to figure 3-11 and adjust the dipper pitch braces in accordance with the type of material being moved and the working conditions. In general, pin the pitch brace in hole 1 for easy digging and low bank cuts. Pin the brace in hole 2 for medium or average soil conditions and bank heights, and in hole 3 for hard digging, high banks, and when grading the area.

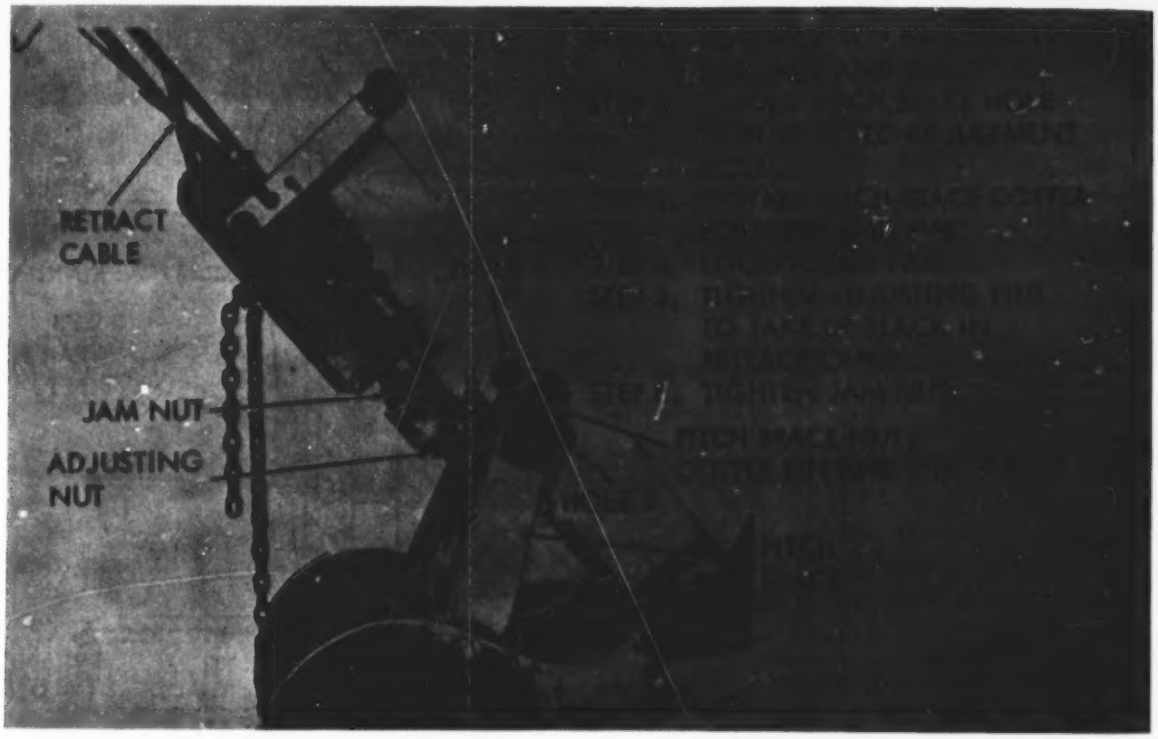

Figure 3-11. Rake angle and retract cable adjustment.

(4) *Retract cable tension adjustment.* Refer to figure 3-11 and adjust retract cable tension.

(5) *Dipper trip cable adjustment.* This adjustment should not normally be necessary unless the dipper trip cable wears or stretches. Therefore, the cable should be inspected to determine that it is safe for further use before it is adjusted. Refer to figure 3-12 and adjust the dipper trip cable tension.

STEP 1. LOOSEN ROPE CLAMP.
STEP 2. TIGHTEN DIPPER TRIP CABLE UNTIL DIPPER TRIP LEVER IS AT RIGHT ANGLE TO DIPPER STICK.
STEP 3. TIGHTEN ROPE CLAMP.

NOTE: SPRING LENGTH SHOULD NOT BE CHANGED. MAKE DIPPER TRIP LEVER ADJUSTMENT BY METHOD SHOWN, LEAVING SPRING ADJUSTMENT UNDISTURBED.

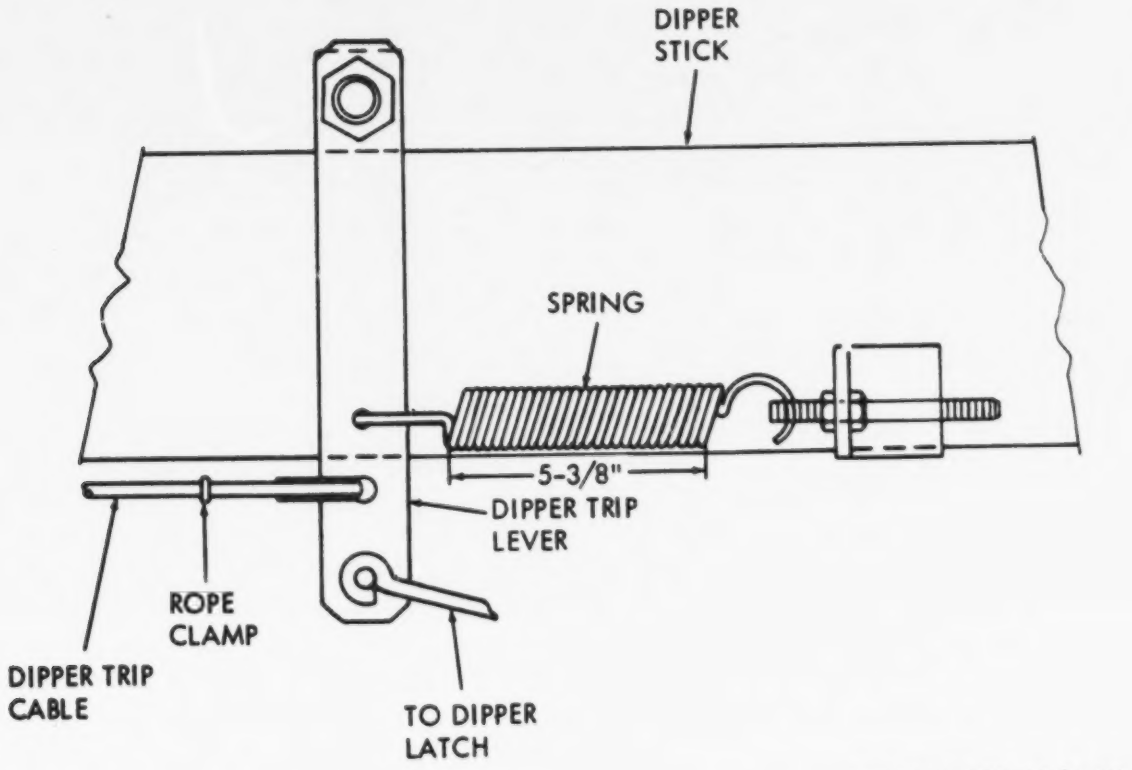

Figure 3-12. Dipper trip cable adjustment.

(6) *Dipper tooth replacement.* Dipper teeth can be kept sharp in service by regularly reversing them, top for bottom, as they wear. When teeth are worn to about one third their original length, they must be replaced. Drive out the attaching pins and replace dipper teeth.

Caution: **No digging should be done with dipper teeth removed. Severe wear can occur to exposed mounting surfaces.**

(7) *Dipper latch bar adjustment.* The dipper latch bar must be adjusted to move forward into the opening in the dipper latch as latch bar wear occurs. Refer to figure 3-13 and adjust the dipper latch bar.

Figure 3-13. Dipper latch bar adjustment.

3-28. Crane, Clamshell, and Dragline Attachment

a. General Service. The components of the crane attachment must be lubricated at the periodic intervals listed in the current LO. When removed from the machine, the crane boom should be placed inside a suitable dry building if possible, preferably supported on wooden blocking. Clean the crane boom, using a suitable cleaning solution. All machined or finished surfaces must be kept lubricated, as required, to prevent rust.

b. Cable Roller and Boom Point Sheave Service. Refer to figure 3-14 and clean the cable rollers and boom point sheaves. Inspect for wear, scoring, or grooving caused by contact between cables, rollers or sheaves. Report any such discrepancy to organizational maintenance.

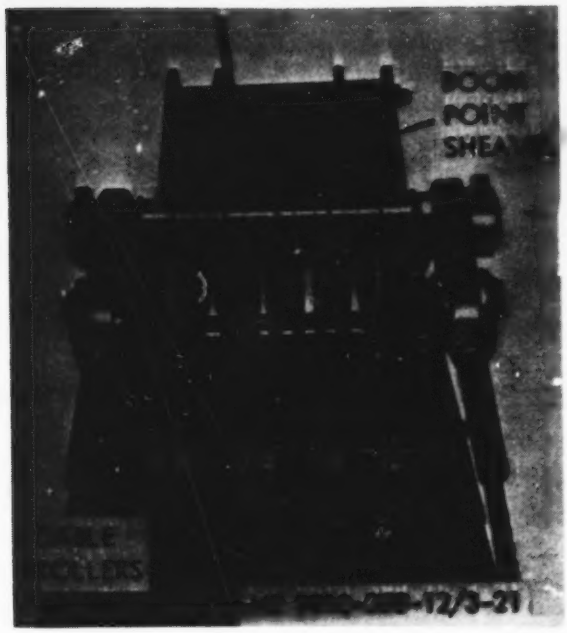

Figure 3-14. Cable roller and boom point sheave service.

c. Hook Block Service and Replacement. The operator crew / personnel's responsibility for hook block service and the method of replacement are outlined below:

(1) *Service.* The hook block (fig. 3-15) must be kept clean. Keep the hook block sheaves lubricated with proper lubricant in accordance with the current LO. The hook block must be inspected by the operator daily, since failure could cause serious damage or injury. The operator must inspect for visible cracks or noticeable increase in hook throat measurements, and report any evidence of a defect to organizational maintenance.

(2) *Replacement.* Lower the hook block to the ground or to suitable blocking. Loosen the cable clamp at the cable dead end. This may be at the boom point or the hook block, depending on the number of parts of line in use. Manually unreeve the hook block. Refer to the reeving diagram, figure 2-12, and replace the hook block.

Figure 3-15. Hook block.

d. Jib and Jib Strut Service and Replacement. Service and replacement procedures for the jib and jib strut are described below.

(1) *Service.* Service of the jib and jib strut is the same as for the crane boom. Refer to paragraph 3-28 (a) and service the jib and jib strut.

(2) *Replacement.* Refer to figure 3-16 and replace the jib and jib strut.

STEP 1. LOWER BOOM AND SUPPORT ON BLOCKING .
STEP 2. REMOVE JIB LOAD LINE.
STEP 3. REMOVE UPPER GUY LINES AND LOWER GUY LINES.
STEP 4. REMOVE JIB STRUT PINS AND REMOVE JIB STRUT.

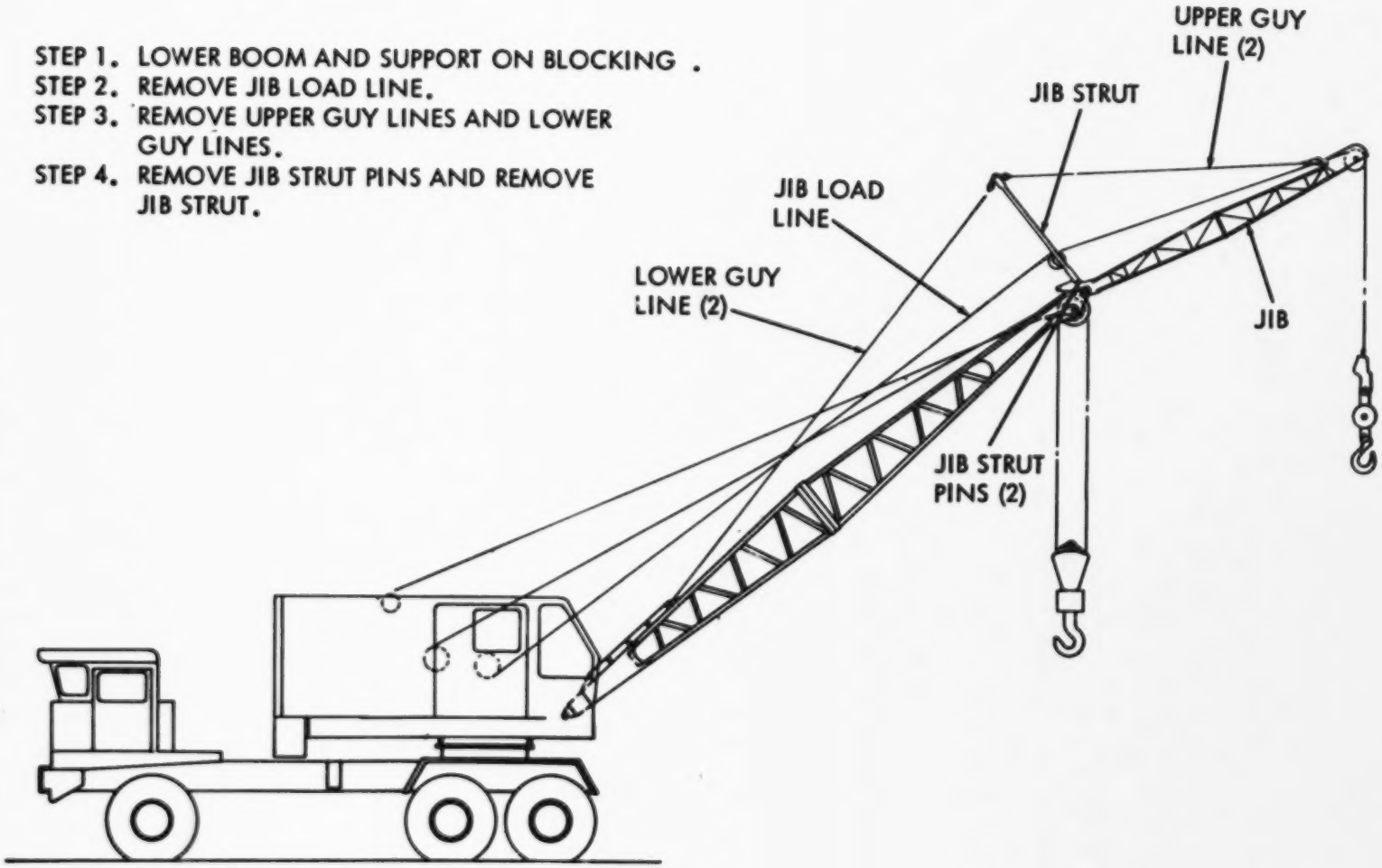

Figure 3-16. Jib and jib strut, removal and replacement.

e. Cable Adjustment and Replacement. Adjustment and replacement procedures for cables are described below.

(1) *Replacement of load cables.* To replace either the front or the rear drum load cable, place the drum brake for the cable to be removed in the brake released position. Refer to paragraph 3-28 (e) and remove the hook block. Raise the boom to any convenient height so that the line hangs downward. One man can now pull the cable off the drum. When the cable end is reached, refer to figure 2-11 and remove the cable wedge from the drum lagging. To install the new cable, place the new cable reel beneath the boom point sheaves. Run the end of the new cable over the boom point sheaves to the correct main drum. Refer to figure 2-11 and install the new cable wedge in the drum, being careful that the cable goes over the top of the rear drum, or beneath the front drum. Being careful, slowly spool the new cable on the selected drum, using the proper drum clutch lever. As this is done, one man should tap the new cable into place on the drum with a soft hammer. A second man should maintain some drag on the new cable reel so the cable is under tension. A third man operates the proper drum clutch lever to wind the cable on the drum.

(2) *Replacement of boom hoist cable.* Provide adequate wooden blocking to support the boom. Lower the boom until it is supported on blocking as illustrated in figure 2-4. Pay off more cable until the upper spreader lies on the boom. Refer to figure 3-17 and disconnect the boom hoist cable from the lower spreader. Refer to figure 2-32 and release the boom hoist pawl and the boom hoist brake. Unreeve the boom hoist line and pull it from the boom hoist drum. The boom hoist drum can be used to pay the line off the drum under power if the operator desires. When this is done, one man standing on the ground must pull the cable out of the cab. Refer to figure 2-11 and remove the cable wedge to complete removal of the cable. Bring the cable reel containing the new cable to a position close to the upper spreader and near the boom. Starting at the center (equalizer) sheave of the upper spreader, reeve the boom hoist cable back to the dead end on the lower spreader as shown in figure 3-17. Pull the rest of the cable off the new cable reel and reeve the other half of the boom hoist cable, back to the boom hoist drum, as shown in figure 2-10. Install the new cable wedge in the boom hoist drum as shown in figure 2-11. Being careful, slowly spool the new cable on the boom hoist drum. As this is done, one man should tap the new cable into place with a soft hammer.

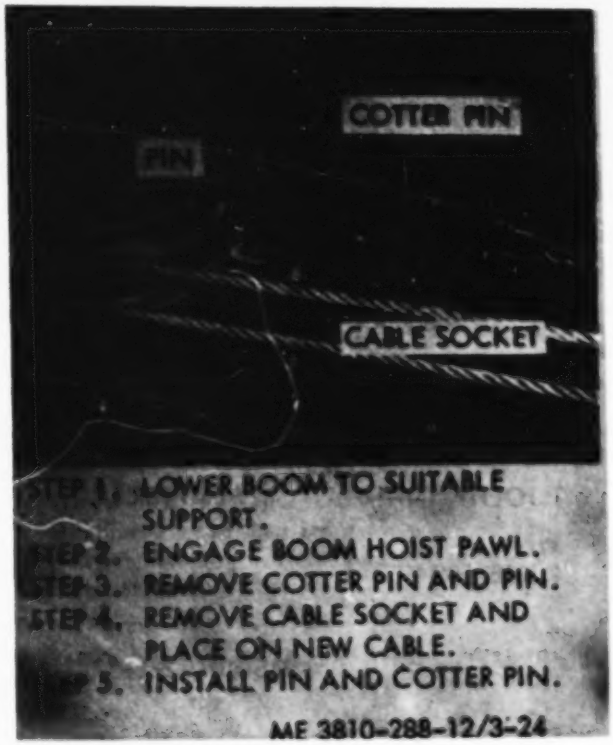
COTTER PIN
PIN
CABLE SOCKET
STEP 1. LOWER BOOM TO SUITABLE SUPPORT.
STEP 2. ENGAGE BOOM HOIST PAWL.
STEP 3. REMOVE COTTER PIN AND PIN.
STEP 4. REMOVE CABLE SOCKET AND PLACE ON NEW CABLE.
STEP 5. INSTALL PIN AND COTTER PIN.
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Figure 3-17. Boom hoist cable lower spreader connection, removal and replacement.

f. Clamshell and Dragline Bucket Service and Replacement. The operator / crew personnel must service and replace the buckets as described below:

(1) *Service.* The bucket must be kept clean. Keep wear points lubricated in accordance with the current LO.

(2) *Replacement.* Bucket teeth must be replaced when they reach one third of their original length. Dragline teeth can be reversed, top for bottom, to equalize wear and keep them sharp during operation. Refer to figure 3-18 and replace bucket teeth.

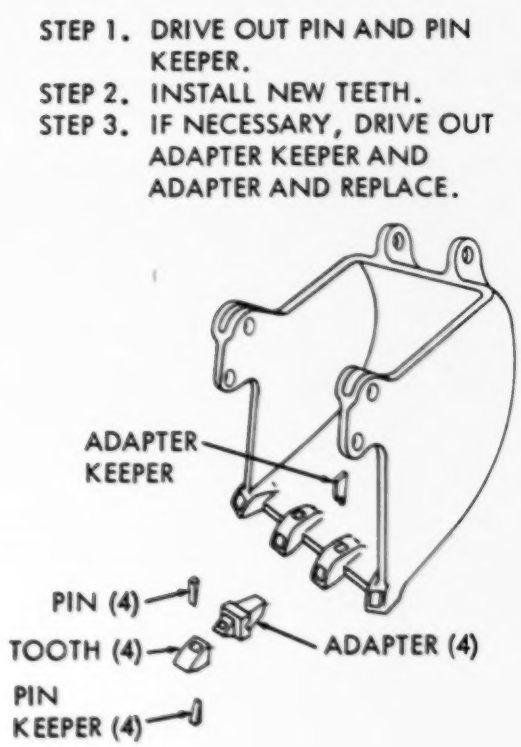
STEP 1. DRIVE OUT PIN AND PIN KEEPER.
STEP 2. INSTALL NEW TEETH.
STEP 3. IF NECESSARY, DRIVE OUT ADAPTER KEEPER AND ADAPTER AND REPLACE.
ADAPTER KEEPER
PIN (4)
TOOTH (4)
PIN KEEPER (4)
ADAPTER (4)
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Figure 3-18. Bucket teeth, removal and replacement.

(3) *Clamshell bucket replacement.* Refer to paragraph 2-5 and replace the clamshell bucket.

(4) *Dragline bucket replacement.* Refer to paragraph 2-6 and replace the dragline bucket.

g. Tagline Service, Adjustment, and Replacement. The operator / crew personnel's service, adjustment, and replacement procedures for the tagline are as follows:

(1) *Service.* The tagline winder must be kept clean. It must be lubricated in accordance with the current LO. Be sure the level of lubricant is checked at least semi-annually.

(2) *Adjustment.* The tagline must be capable of providing sufficient tension to keep the bucket from turning and fouling the clamshell hoisting and closing lines. The approximate tension required on this tagline is 195 pounds. To increase tension, pull the cable out enough to allow an additional wrap on the cable drum. The amount of tension can be varied to suit individual operator preference. The recommended tension is from two to four wraps on the tagline drum.

(3) *Replacement.* The tagline winder is mounted to the crane boom as shown in figure 2-13. Mount the tagline winder at the tip of the boom base section so that a line drawn through the cable drum lines up with the boom point.

h. Fairlead Service and Replacement.

(1) *Service.* Lubricate the fairlead with the type of lubricant listed in the current LO, at the interval listed. Inspect for excessive grooving of the fairlead sheaves or rollers and report any deficiency to organizational maintenance.

(2) *Replacement.* The fairlead is mounted on a bracket located on the front of the revolving frame. Refer to figure 2-14 and remove or replace the fairlead.

3-29. Backhoe Attachment

a. Service. Installation and reeving of the backhoe attachment is covered in paragraph 2-8. Keep the backhoe attachment lubricated in accordance with the current LO. When the attachment is not in use, it should be placed on wooden blocks, if possible, and should be cleaned, using a cleaning solution. All machined or finished surfaces must be kept lubricated as required to prevent rust.

b. Dipper Tooth Replacement. Dipper teeth must be replaced when they are worn to about one third their original length. Refer to figure 3-18 and replace dipper teeth.

3-30. Piledriver Attachment

a. Service. Keep the piledriver attachment clean and lubricate in accordance with the current LO.

b. Replacement. Refer to paragraph 2-7 and replace the piledriver attachment.

3-31. Inspection, Service and Adjustment of Cables

a. Inspection. Daily inspect all cables used for boom or load handling. The inspection is to determine if the cable is suitable for further use. The recommended method is to determine the degree of damage at the worst rope lay. By definition, a rope lay is the distance along the rope in which one strand makes one complete turn around the rope. Any of the following conditions should indicate to the operator that the cable needs replacing.

(1) If the core shows through more than one pair of strands.

(2) If kinking damage is severe.

(3) If there is evidence of improper lubrication. (This will usually cause other defects.)

(4) If the cable has come into contact with an electrical circuit or has been overheated in some other manner.

(5) If there is a serious reduction in rope size.

(6) If there is evidence of "bird-caging". This condition of suddenly increased size is usually

caused by the sudden release of a heavy load while the cable is twisted.

(7) Broken wires at the dead end (tied down end) of a cable are cause for cutting off a section. Cut at least three feet beyond the broken wires. Then refasten or resocket the rope.

(8) If there are numerous broken wires, or as many as three adjacent broken wires in one rope lay.

(9) If corrosion or rust damage is apparent.

b. Service. Normal service for cables is to keep them clean, using a wire brush, scraper, or compressed air. After the cable is clean, it should be lubricated after every 50 hours of operation.

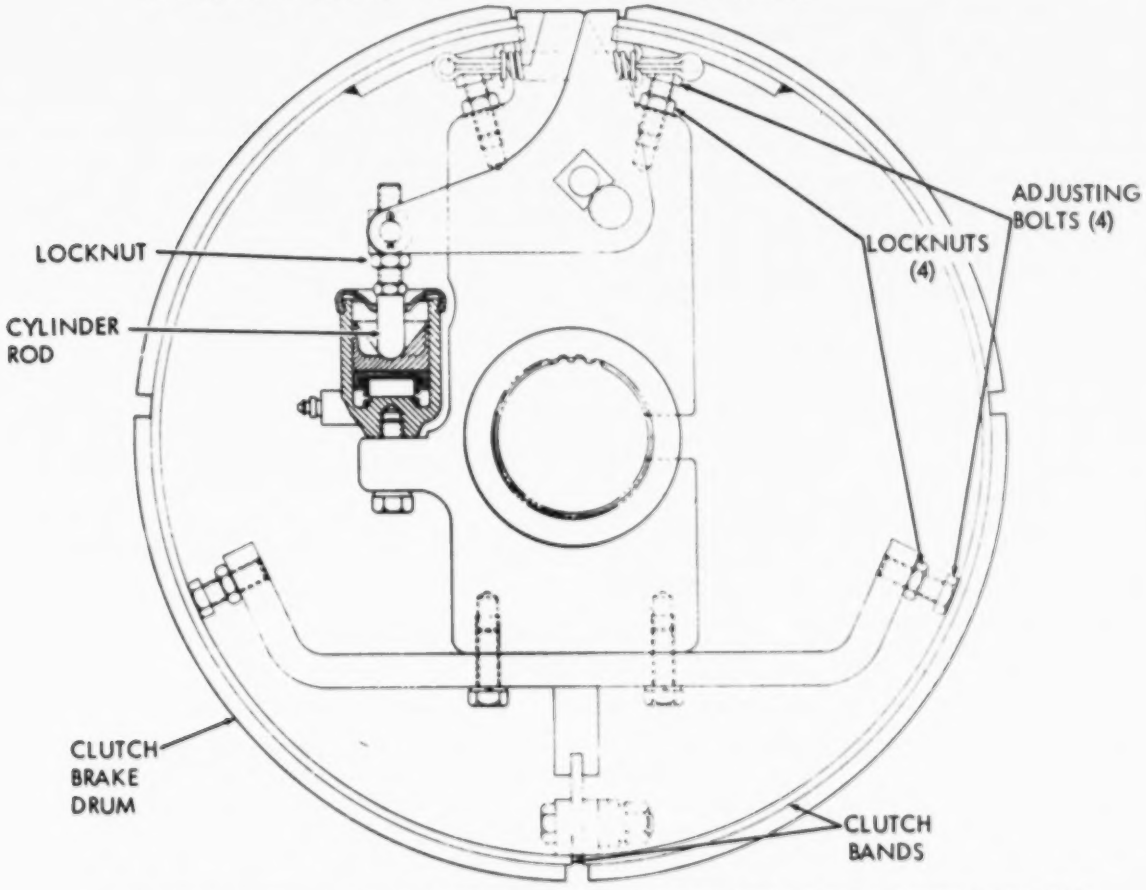
c. Adjustment. Adjustment of cables consists of cutting to proper length. When cutting cable, seizings must be placed on each side of the point where the cable will be cut. On preformed cable, one seizing on each side of the cut is enough. On non-preformed cable less than 7/8 inch in diameter, two seizings are to be used. On non-preformed cable over 7/8 inch in diameter, three seizings are recommended. Use abrasive cutting tools, wire cutters or blade action tools, or flame cutters. (See table 1-1 for cable specifications.)

3-32. Rear Drum Clutch Service and Adjustment

a. Service. Keep the mechanical components of the clutch clean and dry. Do not allow hydraulic fluid to come into contact with clutch linings.

b. Adjust. Refer to figure 2-32 and place the rear drum clutch lever in the centered (neutral) position. Refer to figure 3-19 and adjust the rear drum clutch. Position the clutch as desired by "tapping" the engine start pushbutton, with the ignition switch in the OFF position.

STEP 1. LOOSEN LOCKNUTS (4) WHICH SECURE ADJUSTING BOLTS (4).
STEP 2. TURN ADJUSTING BOLTS OUT OF CONTACT WITH CLUTCH BANDS. CLUTCH BANDS MUST BE CENTERED IN CLUTCH DRUM. USE ADJUSTING BOLTS (4) TO CENTER CLUTCH BANDS. TIGHTEN LOCKNUTS.
STEP 3. LOOSEN LOCKNUT ON CYLINDER ROD.
STEP 4. TURN CYLINDER ROD OUT UNTIL A PULL OF 15 TO 20 POUNDS ON A SPRING SCALE IS NEEDED TO ENGAGE THE CLUTCH. TIGHTEN LOCKNUT.



NOTE: ONLY STEPS 3 AND 4 ABOVE ARE NECESSARY TO ADJUST FOR LINING WEAR. USE COMPLETE PROCEDURE ONLY WHEN CLUTCH HAS BEEN REMOVED AND REPLACED.

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Figure 3-19. Adjusting front and rear drum clutch.

3-33. Front Drum Clutch Service and Adjustment

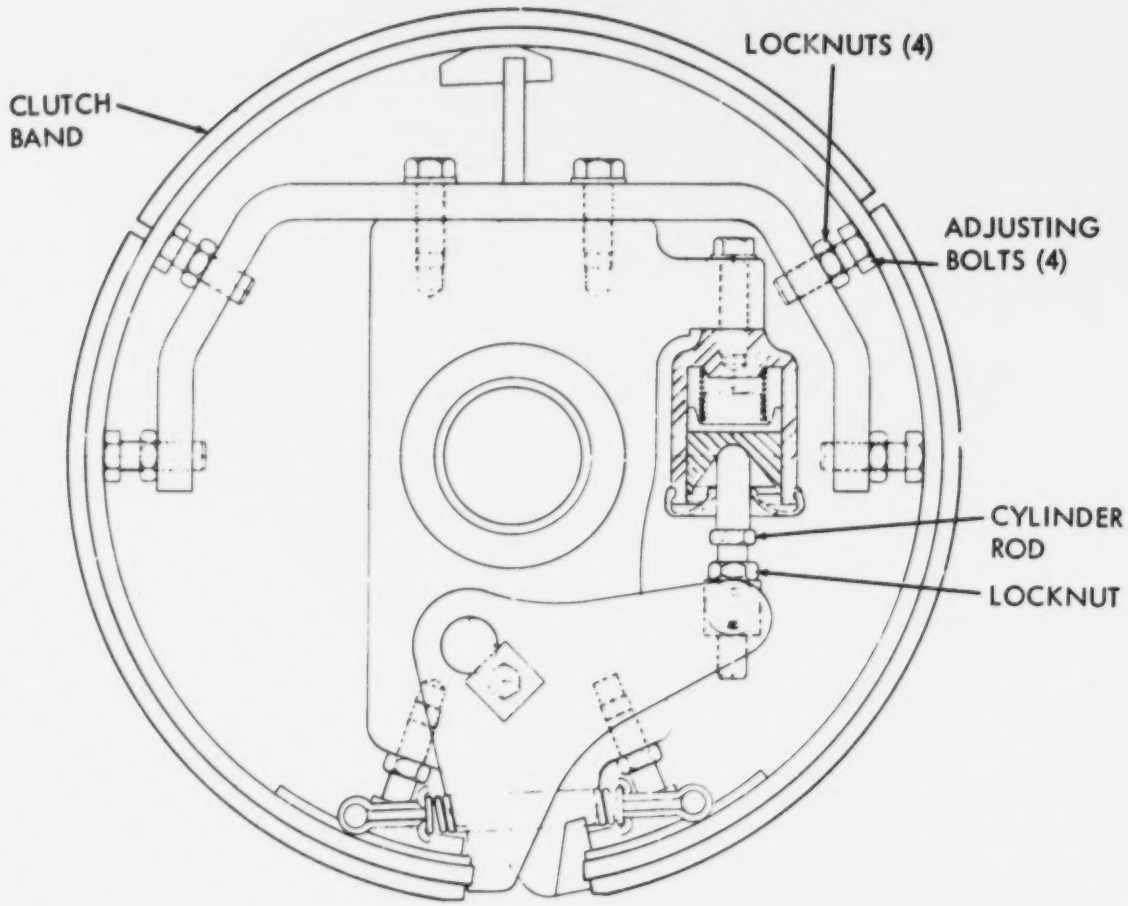
a. Service. Keep the mechanical components of the clutch clean and dry. Do not allow hydraulic fluid to come into contact with clutch linings.

b. Adjust. Adjustment of this clutch is identical to the adjustment of the rear drum clutch, except that the front drum clutch lever instead of the rear drum clutch lever (fig. 2-32) must be placed in the centered (neutral) position. Refer to figure 3-19 and adjust the front drum clutch. Position the clutch as desired by "tapping" the engine start pushbutton, with the ignition switch in the OFF position.

3-34. Boom Hoist Clutch Service and Adjustment

a. Service. Keep the mechanical components of the boom hoist clutch clean and dry. Do not allow hydraulic fluid to come into contact with clutch linings.

b. Adjust. Refer to figure 2-32 and place the boom hoist clutch lever in the centered (neutral) position. Refer to figure 3-20 and adjust the boom hoist clutch.



STEP 1. LOOSEN LOCKNUTS WHICH SECURE ADJUSTING BOLTS.
STEP 2. TURN ADJUSTING BOLTS OUT OF CONTACT WITH CLUTCH BAND. CLUTCH BAND MUST BE CENTERED IN CLUTCH DRUMS. USE ADJUSTING BOLTS TO CENTER CLUTCH BAND. TIGHTEN LOCKNUTS.
STEP 3. LOOSEN LOCKNUT ON CYLINDER ROD.
STEP 4. TURN CYLINDER ROD OUT UNTIL A PULL OF 15 TO 20 POUNDS ON A SPRING SCALE IS NEEDED TO ENGAGE THE CLUTCH. TIGHTEN LOCKNUT ON CYLINDER ROD.

NOTE: ONLY STEPS 3 AND 4 ABOVE ARE NECESSARY TO ADJUST FOR LINING WEAR. USE COMPLETE PROCEDURE ONLY WHEN CLUTCH HAS BEEN REMOVED AND REPLACED.

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Figure 3-20. Adjusting boom hoist clutch.

3-35. Reversing Shaft and Horizontal Swing Shaft Clutch Service and Adjustment

a. Service. Keep the mechanical components of the reversing shaft clutch and the horizontal swing shaft clutches clean and dry. Do not allow hydraulic fluid to come into contact with clutch linings. Both swing clutches and the reversing shaft clutch are identical.

b. Adjust. Refer to figure 2-32 and place the control lever for the clutch being adjusted in the centered (neutral) position. Refer to figure 3-21 and adjust the reversing shaft clutch or the horizontal swing shaft clutch.

STEP 1. LOOSEN LOCKNUTS ON ADJUSTING SCREWS.
STEP 2. REFER TO FIGURE 2-32 AND ENGAGE THE SWING CLUTCH LEVER.
STEP 3. BACK OFF ON ALL ADJUSTING SCREWS UNTIL THERE IS A 0.020 INCH GAP BETWEEN HEADS OF ADJUSTING SCREWS AND CLUTCH SHOES. TIGHTEN LOCKNUTS AND RECHECK GAP.

NOTE: MAKE ABOVE ADJUSTMENT FOR FIRST ONE CLUTCH SHOE AND THEN THE OTHER. BE SURE CLUTCH SHOES DO NOT DRAG.

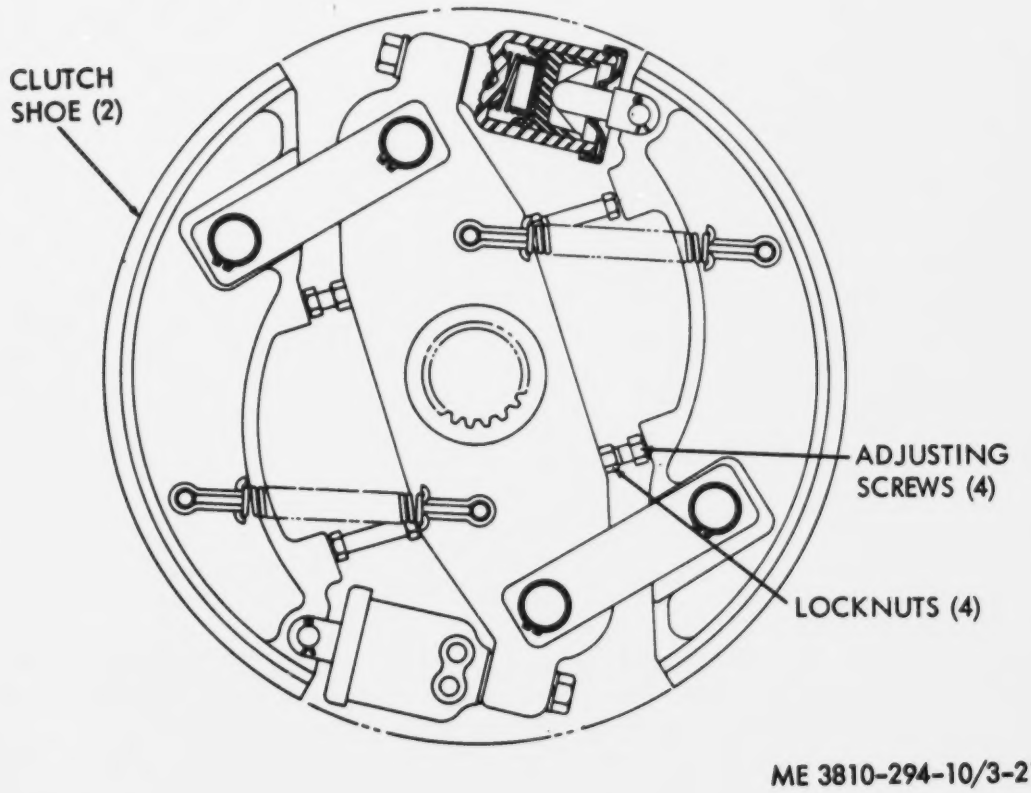

Figure 3-21. Adjusting reversing shaft clutch or horizontal swing shaft clutch.

3-36. Front and Rear Drum Brake Service and Adjustment

a. Service. Keep the mechanical components of the rear drum brake clean and dry. Do not allow hydraulic fluid to come into contact with brake linings.

b. Adjust. The adjustment of both of these brakes is identical and is done with hydraulic pressure off. No pressure should be placed on the operating foot pedal. Refer to figure 3-22 and adjust the front or rear drum brake.

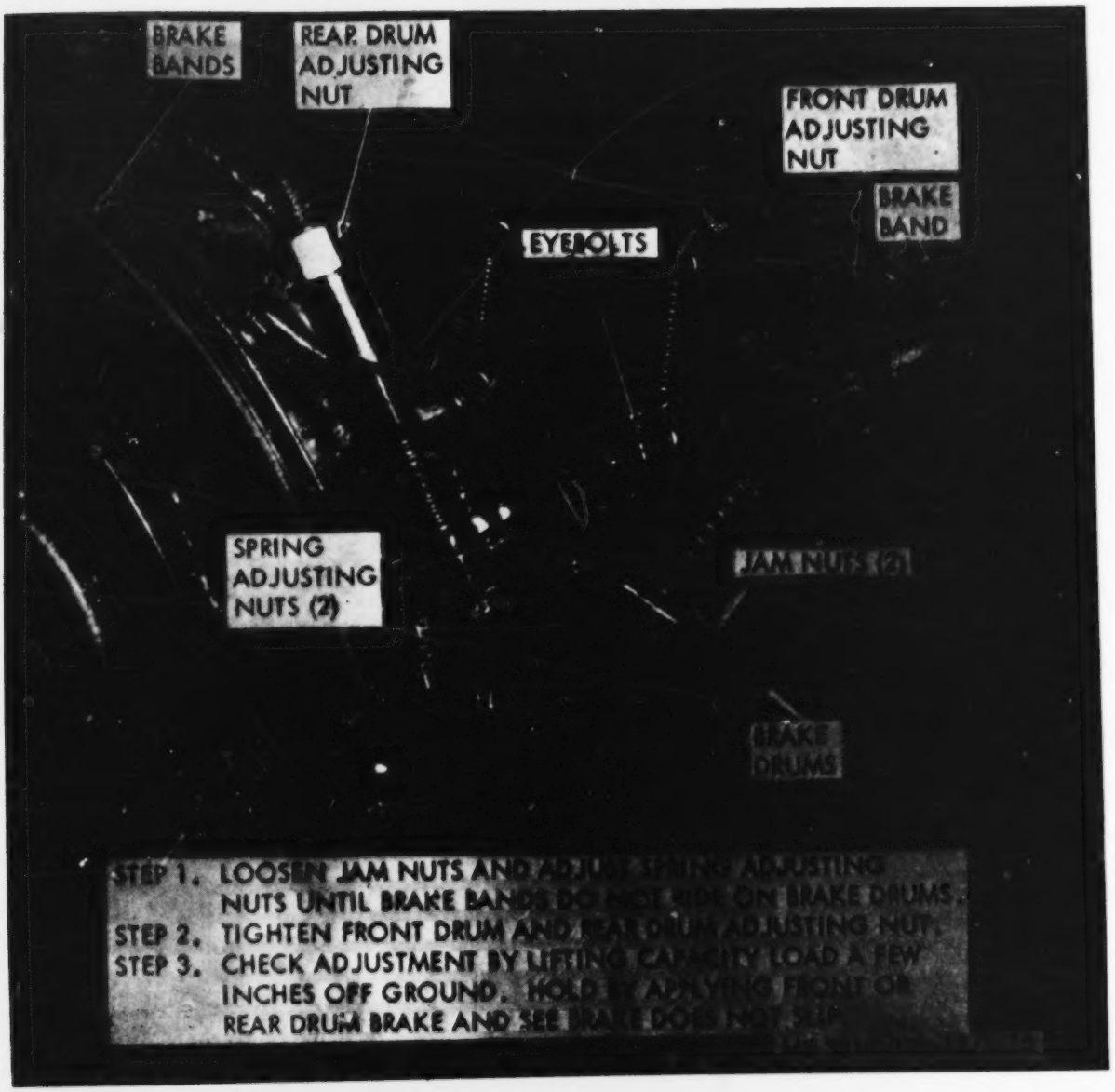

Figure 3-22. Adjusting front and rear drum brakes.

3-37. Boom Hoist Brake Inspection

Keep the mechanical components of the boom hoist brake clean and dry. Do not allow hydraulic fluid or any lubricant to come into contact with brake linings.

3-38. Swing Brake Service and Adjustment

a. Service. Keep the mechanical components of the swing brake clean. Lubricate in accordance with the current LO. Keep locknuts tightened.

b. Adjust. Refer to figure 2-32 and place the swing brake lever in the released position. Refer to figure 3-23 and adjust the swing brake.

Note. The swing brake is not used to stop the revolving frame from swinging while the machine is in operation. It is used solely to prevent the revolving frame from turning while the machine is not in use, such as when it is being moved from place to place.

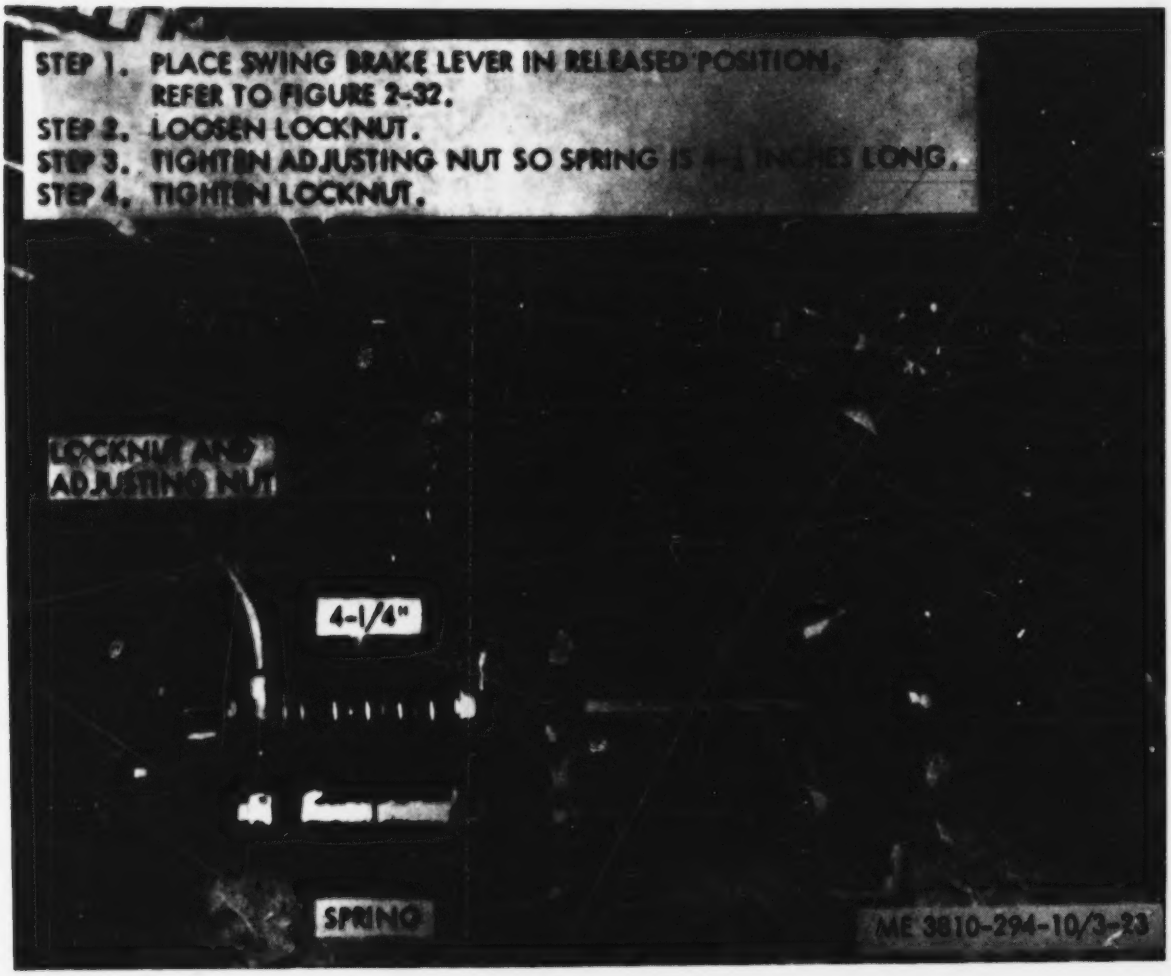
STEP 1. PLACE SWING BRAKE LEVER IN RELEASED POSITION.
REFER TO FIGURE 2-32.
STEP 2. LOOSEN LOCKNUT.
STEP 3. TIGHTEN ADJUSTING NUT SO SPRING IS 4-1/4 INCHES LONG.
STEP 4. TIGHTEN LOCKNUT.
4-1/4"
SPRING
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Figure 3-23. Swing brake adjustment.

3-39. Control Levers and Pedals

a. Service. No service except lubrication and cleaning is required for control levers or pedals. Lubricate in accordance with the current LO.

b. Adjust. No adjustments should normally be required. However, stopscrews (adjusting screws) are furnished to limit the fore and aft movement of all control levers and pedals, as illustrated in figure 3-24. Operators will adjust only spring return tension on front and rear drum brake pedals, and this adjustment will be made only after carefully checking front and rear drum brake adjustment. Refer to figure 3-25.

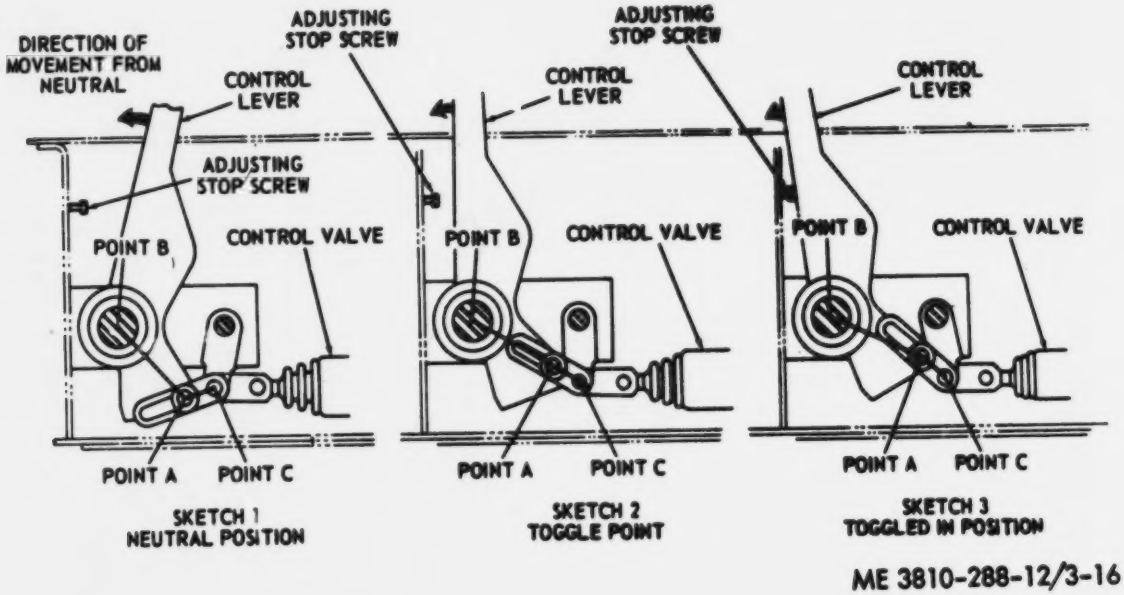


Figure 3-24. Toggle linkage adjustment.

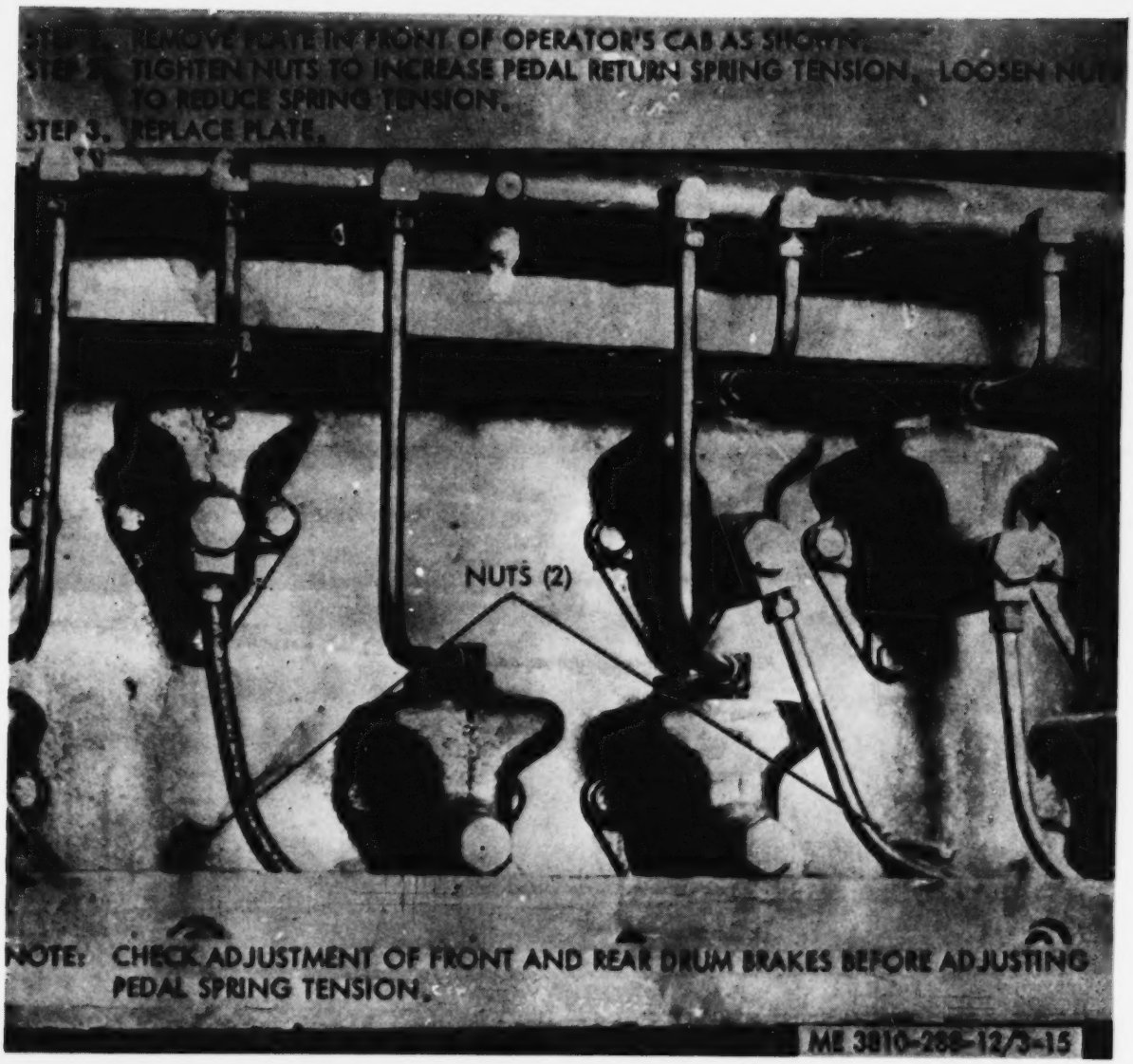

STEP 1. REMOVE PLATE IN FRONT OF OPERATOR'S CAB AS SHOWN.
STEP 2. TIGHTEN NUTS TO INCREASE PEDAL RETURN SPRING TENSION. LOOSEN NUTS TO REDUCE SPRING TENSION.
STEP 3. REPLACE PLATE.
NUTS (2)
NOTE: CHECK ADJUSTMENT OF FRONT AND REAR DRUM BRAKES BEFORE ADJUSTING PEDAL SPRING TENSION.
ME 3810-288-12/3-15

Figure 3-25. Adjusting front and rear drum brake pedal return spring tension.

c. Toggle Levers. The front drum clutch lever, the rear drum clutch lever, the boom hoist clutch lever, and the swing brake lever are designed to "toggle in". Figure 3-24 illustrates the principles of operation of toggle linkage, which must be understood in order to adjust such linkage. When the linkage moves from the neutral position shown in Sketch 1, point A approaches the straight line (or toggle point), as shown in Sketch 2. In the position shown in Sketch 2, the greatest possible amount of force is exerted outward against points B and C, with little effort on either the neutral position or the "toggled in" position with a minimum amount of effort. All the operator has to do is provide the amount of force needed to push the lever past the toggle point in either direction, and the force exerted against points B and C will force the lever as far in that direction as it can go. In Sketch 3, the operator has pushed the control lever past the toggle point. The lever will now stay in the forward position until the operator pulls it back, past the toggle point, to the neutral (centered) position. It is important that only the four levers which are designed for toggle linkage action, and which are listed in this paragraph, be allowed to "toggle in" Refer to figure 3-24 and adjust toggle linkage.

3-40. Chain Adjustments

a. Shovel Crowd Chain Adjustment. Adjustment procedures for the shovel crowd chain are covered in paragraph 3-27 and figure 2-25.

b. Reversing Shaft Chain Adjustment.

(1) Refer figure 3-26 to locate reversing shaft chain eccentric shaft wrench block.

(2) Loosen four capscrews (1, fig. 3-27).

(3) Tighten wrench block (2) until the total midspan chain slack is between ¼ and ⅜ inch.

(4) Tighten the four capscrews.

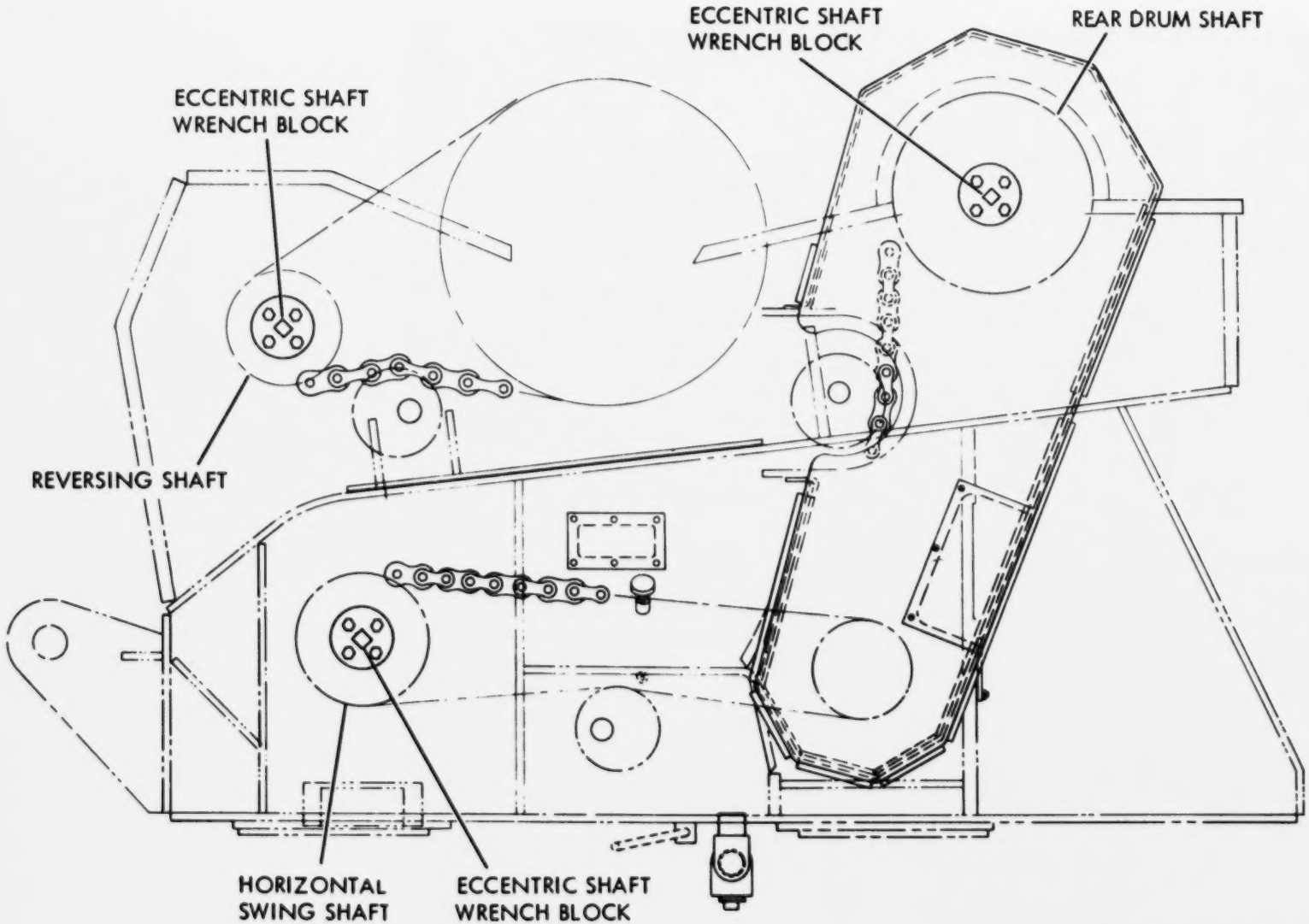


Figure 3-26. Location of chains and chain shafts.

Figure 3-27. Chain case.

c. Rear Drum Chain Adjustment. Repeat the above procedure to adjust the rear drum chain.

Note. Total midspan chain slack should be approximately ½ inch.

d. Horizontal Swing Shaft Chain Adjustment. Repeat step *c.* to adjust the horizontal swing shaft chain.

3-41. Engine Inspection

Visually inspect the engine and engine accessories for fluid leaks or any other physical damage which would make it unsafe to start or run the engine. Inspect the fan for bent or otherwise damaged blades, loose mounting bolts, misalignment, or an unbalanced condition. Inspect the breather cap for cleanliness. If necessary, rinse the breather cap in clean diesel fuel or kerosene and allow to drain dry before replacing.

3-42. Fire Extinguisher

a. Inspection. Every six months inspect the fire extinguisher to ensure that it is full and that seal is not broken. See that the weight of the contents is within ¼ pound of the limits shown on the fire extinguisher.

b. Replacement. Replace fire extinguishers which have been used, the seals of which have been broken, or which have lost weight of ¼ pound or more, with a serviceable unit.

PART TWO

CARRIER

CHAPTER 4

INTRODUCTION

Section I. GENERAL

4-1. Purpose and Scope

This part of the manual contains instructions for your use in operating, servicing and maintaining the carrier portion of the Harnischfeger truck crane model M320T2. Operator / crew personnel should read the instructions provided in both parts of this manual before operating or servicing the machine.

Section II. DESCRIPTION AND DATA

4-2. Description

a. General. The carrier for the Harnischfeger model M320T2 truck crane provides the mounting base for the crane machinery, and the means by which the equipment can be transported from one work site to another.

b. Carrier. The carrier includes the carrier frame which supports the crane machinery, the front and tandem rear axle assemblies and suspension, the engine, transmission transfer case and drive shafts, the operator's cab, and outriggers.

4-3. Tabulated Data

Refer to paragraph 1-4 for tabulated data and identification and instruction plate information.

CHAPTER 5

OPERATING INSTRUCTIONS

Section I. OPERATING PROCEDURES

5-1. General

Refer to paragraphs 2-1 and 2-2 for equipment inspection and servicing procedures and for installation or setting up instructions.

5-2. Controls and Instruments

a. General. The carrier operating controls and instruments are shown in figure 5-1. A description of each control is given below. The controls are listed in the order of their appearance on figure 5-1.

Note. The operator must study the information in this section, and be thoroughly familiar with location and function of each control, before attempting to operate the machine.

b. Controls.

(1) *Master light switch.* The master light control switch (fig. 5-1) has three handles. They are:

(a) Lock lever A. This lever prevents the outside lamp selector lever (lever B) from moving, except into the blackout position. This prevents accidental actuation of lights under blackout conditions. Move this lever upward and hold to allow lever B to be turned to any position other than blackout.

(b) Outside lamp selector switch B. The desired combination of lights may be selected by the operator by lifting lock lever A and turning switch B. This lever has five positions. They are:

(1) Blackout drive
(2) Blackout marker
(3) Off
(4) Stop lights
(5) Service drive

(c) Panel light selector switch C. This switch selects the type of panel lighting in four positions, as follows:

(1) Park
(2) Off
(3) Dim
(4) Bright

(2) *Cab dome light switch.* This switch controls the cab dome lights.

(3) *Oil temperature warning light.* This light will turn on when oil pressure is below the safe maximum.

(4) *Water temperature warning light.* This light will turn on when water temperature is above the safe maximum.

(5) *Engine oil pressure gage.* This gage indicates the oil pressure in the carrier engine. Normal oil pressure is 40 psi, with an acceptable variation of 5 psi above or below.

(6) *Left turn directional lamp.* This lamp will "blink" when the directional turn lever is pulled downward to signal a left turn.

(7) *Speedometer / odometer.* This instrument indicates the carrier speed in miles per hour and accumulated total carrier mileage.

(8) *High beam indicator.* This lamp is illuminated when the carrier headlights are on high beam.

(9) *Tachometer / hourmeter.* This instrument indicates engine speed in hundreds of revolutions per minute and accumulated engine operating time in hours.

(10) *Right turn directional lamp.* This lamp will "blink" when the directional turn lever is pushed upward to signal a right turn.

(11) *Air pressure gage.* This gage indicates air pressure in the air brake system in pounds per square inch (psi).

(12) *Park abort control.* This control is used to drain down air pressure in the air brake system and maintain the brake shoes out of contact with the brake drums for long term parking when it is necessary to be sure brake shoes do not freeze to brake drums.

(13) *Engine throttle control.* Pull out on this control to increase engine idle speed. Push in on the control to decrease engine speed.

(14) *Reservoir drain valve.* Depress and hold this valve depressed to drain all air pressure from the air brake reservoir.

(15) *Tractor protection valve.* This valve is used only when towing another vehicle, and should not be pushed in when another vehicle is not being towed. In normal towing service, push the valve in. In an emergency, if it becomes necessary to apply the brakes of the towed vehicle, pull this valve out.

(16) *Emergency-release park lever.* This lever selects the basic mode of operation of the air brake system. Place the lever in the RELEASED position for normal operation. Place the lever in the EMERGENCY position for short term parking. Place the lever in the PARK position for long term parking.

(17) *Interaxle differential lockout.* When very

slippery road conditions are encountered, or when very bumpy off-road conditions are encountered, depress this pushbutton and hold it depressed for maximum traction. This control should be used only when necessary, since it imposes extra strain on axle mechanisms.

(18) *Dry road-slippery road switch.* Place this lever in the SLIPPERY ROAD position when slippery driving conditions are encountered. This will reduce air brake pressure to front wheel service brakes by 50 per cent, thus assisting in preventing skidding. Return to the DRY ROAD position as soon as conditions will allow.

(19) *Windshield wiper switch.* This switch turns the windshield wipers on and off.

(20) *Fuel level gage.* This gage indicates the remaining amount of fuel in the fuel tank.

(21) *Panel lamp.* Turn to illuminate panel.

(22) *Panel lamp.* Turn to illuminate panel.

(23) *Water temperature gage.* This gage indicates water temperature in degrees Fahrenheit. Normal temperature, while running, is between 160 and 200 degrees.

(24) *Panel lamp.* Turn to illuminate panel.

(25) *Battery-generator indicator.* This device is a voltmeter and is designed to indicate the condition of the battery and to assist in diagnosing other troubles. Refer to figure 2-33 for further information.

(26) *Ignition switch.* Turn this switch clockwise to turn on the engine ignition. Turn the switch counterclockwise to turn the ignition off.

(27) *Hazard warning switch light.* This light will blink when the hazard warning switch (item 28) is turned on.

(28) *Hazard warning switch.* This switch turns on flashing lights at all four corners of the carrier. (see also item 43).

(29) *Horn button.* Depress this button to sound the carrier horn.

(30) *Directional signal lever.* Pull this lever down to turn on the left turn directional signal. Push this lever up to turn on the right turn directional signal.

(31) *Trailer brake lever.* When towing another vehicle, pull this lever down to apply the brakes of the towed vehicle.

(32) *Windshield washer control.* Depress this button to squirt windshield cleaning fluid on the windshield.

(33) *Headlight dimmer switch.* Depress this switch to change from low beam headlights to high beam. Depress the switch again to reverse the process.

(34) *Clutch pedal.* Depress this pedal to disengage the carrier engine clutch while shifting gears.

(35) *Brake treadle valve.* Depress this pedal to apply the carrier service brakes, and the brakes on the towed vehicle, when towing another vehicle.

(36) *Accelerator pedal.* Depress this pedal to increase carrier speed.

(37) *Main transmission shift lever.* Depress clutch pedal (item 36) and shift the main transmission as indicated on the transmission shift instruction plate on the carrier dash.

(38) *Transmission shift button.* Pull up on this button to shift the main transmission from the low speed range to the high speed range, or push it down to shift from the high speed range to the low speed range.

(39) *Transfer case control lever.* Place this lever in HIGH for normal highway driving. Place the lever in LOW for off-highway driving. A neutral position is also available. Stop the carrier before shifting.

(40) *Front axle control lever.* Place this lever in the IN position when front wheel drive is to be used. Keep the lever in the OUT position when driving under normal highway conditions.

(41) *Low air pressure indicator.* This flag type indicator will allow the flag to drop when air pressure drops below the safe operating range.

(42) *Windshield wiper hand lever.* This lever may be used to operate the windshield wiper blade manually.

(43) *Engine choke control.* This control is used to manually control the carburetor choke. It should be pulled out during cold engine start up and pushed in when the engine is running smoothly.

KEY to fig. 5-1.

1. Master light switch
2. Cab dome light switch
3. Oil temperature warning switch
4. Water temperature warning light
5. Engine oil pressure gage
6. Left turn directional lamp
7. Speedometer / odometer
8. High beam indicator
9. Tachometer - hourmeter
10. Right turn directional lamp
11. Air pressure gage
12. Park abort control
13. Engine throttle control
14. Reservoir drain valve
15. Tractor protection valve
16. Emergency - release - park lever
17. Interaxle differential lockout
18. Dry road - slippery road switch
19. Windshield wiper switch
20. Fuel level gage
21. Panel lamp
22. Panel lamp
23. Water temperature gage
24. Panel lamp
25. Battery - generator indicator
26. Ignition switch
27. Hazard warning switch light
28. Hazard warning switch
29. Horn button
30. Directional signal lever
31. Trailer brake lever
32. Windshield washer control
33. Headlight dimmer switch
34. Clutch pedal
35. Brake treadle valve
36. Accelerometer pedal
37. Main transmission shift lever
38. Transmission shift button
39. Transfer case control lever
40. Front axle control lever
41. Low air pressure indicator
42. Windshield wiper hand lever
43. Engine choke control

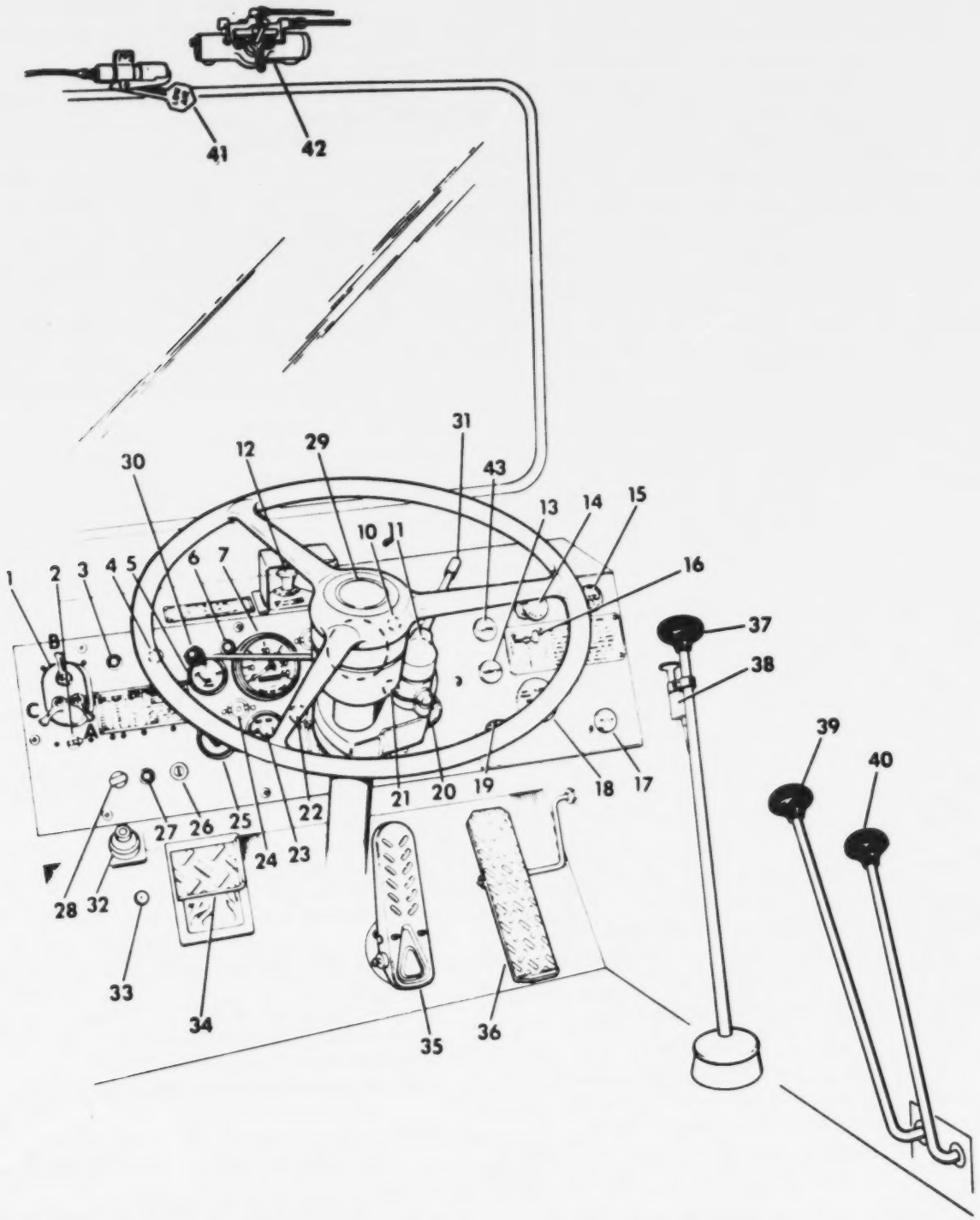


Figure 5-1. Carrier instruments and controls.

5-3. Brake System Operation

a. Driving Normally. There are three positions of EMERGENCY-RELEASE-PARK lever (fig. 5-1, item 16). To operate the carrier normally, drive to the work site in the RELEASE position, stop the carrier, and place the control in the EMERGENCY position. This position is used for short term parking. When ready to move, flip the control to the RELEASE position and drive away.

b. Overnight Parking. When through working for the day, or when intermediate term parking (several hours) is required, drive to the point where the carrier will be parked. Stop the carrier and place the lever (fig. 5-1, item 16) in the PARK position. This will drain air pressure from the system and mechanically engage the carrier brakes. When ready to move the carrier again, start the engine, place the lever in the EMERGENCY position, and wait until the low pressure indicator flag (fig. 5-1, item 41) goes up. This may take as much as five minutes, and there may be an interval at about 95 psi air pressure when the charging seems to slow down. This is normal and should be overlooked. Also, the low air pressure buzzer will be on while the air pressure is rising, and this buzzer can not be shut off. When the low air pressure flag goes up, place the lever in the RELEASE position and drive the carrier normally.

c. Park Abort. When it is necessary to park the carrier for more than eight hours, in extreme cold, or under damp conditions, it is placed in the PARK ABORT condition by means of item 12, figure 5-1. Under these circumstances, the air supply is bled out of the entire system and the brake shoes are mechanically prevented from coming in contact with the brake drums.

Warning: **While in the park abort condition, the carrier will have no brakes. Always block the wheels so as to prevent truck crane motion before placing the machine in the park abort condition. Do not remove blocking until the carrier is returned to normal brake system operation as follows:**

(1) Start engine.

(2) Place lever (fig. 5-1, item 16) in EMERGENCY position and run engine until the low air pressure flag rises, indicating system pressure is within the operating range.

(3) Place the lever in the RELEASE position. The carrier brake system is now ready for normal operation.

d. Towing Another Vehicle. To tow another vehicle, proceed as follows:

(1) Connect both the EMERGENCY and SERVICE BRAKE systems at the rear of the truck crane to the vehicle to be towed.

(2) Place lever (fig. 5-1, item 16) in the EMERGENCY position and run the engine until the carrier air pressure is at least 50 psi. It is recommended that the towed vehicle not be moved until it reaches normal system pressure. When the low air pressure flag rises, place the lever in the release position.

(3) Depress valve (15, fig. 5-1). The towed vehicle brakes will now operate when the carrier air brakes operate, and the carrier can be driven normally. The trailer brake lever (31, fig. 5-1) is used to apply the brakes on the towed vehicle only. Be careful to avoid too much speed on grades and use more caution than usual when towing another vehicle.

5-4. Front Axle Drive

a. General. The use of the driving front axle should be restricted to off highway or very rough or slippery conditions. When front axle drive is used, the operator should also consider engaging the interaxle differential lockout, as well as the SLIPPERY ROAD position of item 18, figure 5-1.

b. Engaging Front Axle Drive. To engage the front axle drive, proceed as follows:

(1) Stop the vehicle completely.

(2) Shift the transfer case into the LOW position.

(3) Shift the front axle control lever (40, fig. 5-1) to the IN position.

(4) Shift the main transmission lever to the desired starting position and bring the carrier up to operating speed in the usual manner.

c. Disengaging Front Axle Drive. Disengage front axle drive as follows:

(1) Stop the carrier.

(2) Shift the transfer case into the HIGH range.

(3) Shift the front axle control lever to the OUT position.

(4) Bring the carrier up to speed, using the main transmission shift lever.

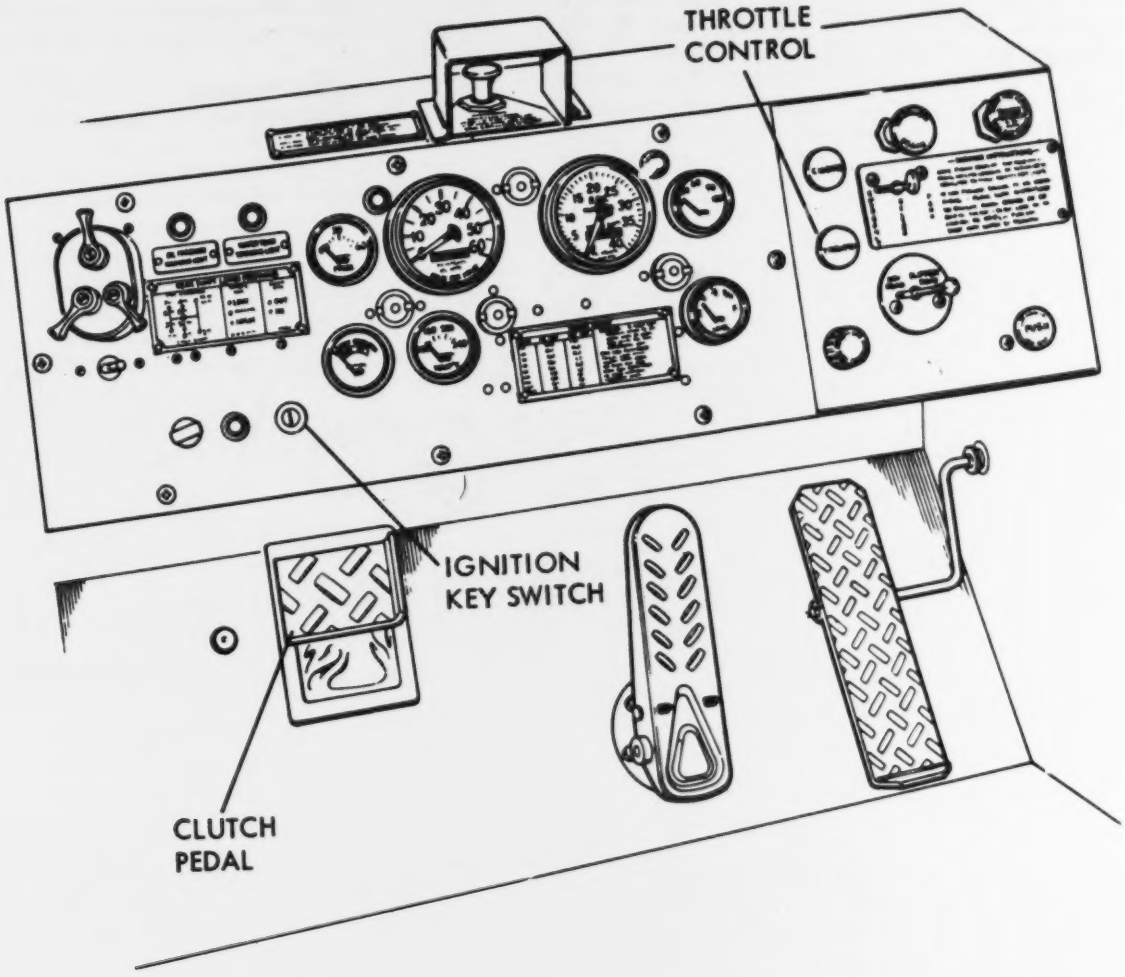
5-5. Starting

a. Preparation for Starting.

(1) Perform the pre-operation services (para 2-1).

(2) Lubricate the carrier as specified in the current LO.

b. Starting. Refer to figure 5-2 and start the carrier.



STEP 1. DEPRESS CLUTCH PEDAL.
STEP 2. TURN IGNITION KEY SWITCH TO START POSITION. WHEN ENGINE STARTS, RELEASE AND ALLOW KEY TO RETURN TO ON POSITION.
STEP 3. PULL OUT THE THROTTLE CONTROL AS NECESSARY TO MAINTAIN ENGINE IDLE SPEED AS THE ENGINE WARMS UP.
STEP 4. CHECK FOR WARNING LIGHT OR ABNORMAL GAUGE INDICATIONS.

CAUTION: DO NOT CRANK ENGINE FOR MORE THAN 30 SECONDS CONTINUOUSLY WITHOUT ALLOWING A 2-MINUTE COOLING PERIOD. IF ENGINE DOES NOT START AFTER A FEW TRIES, STOP CRANKING. DETERMINE CAUSE AND CORRECT OR REPORT CONDITION TO ORGANIZATIONAL MAINTENANCE.

ME 3810-294-10/5-2

Figure 5-2. Starting the engine.

c. Engine Warmup. Start the engine and bring it to a fast idle (approx. 650 to 750 rpm) until normal operating temperature is reached, and the oil pressure gauge shows operating readings.

(1) In cold weather, warmup time can be reduced by keeping the engine radiator covered.

(2) Watch the engine oil pressure gauge closely. If the gauge does not indicate oil pressure within 15 seconds after starting the engine, stop the engine and report this condition to organizational maintenance.

5-6. Stopping the Engine

Refer to figure 5-3 and stop the engine.

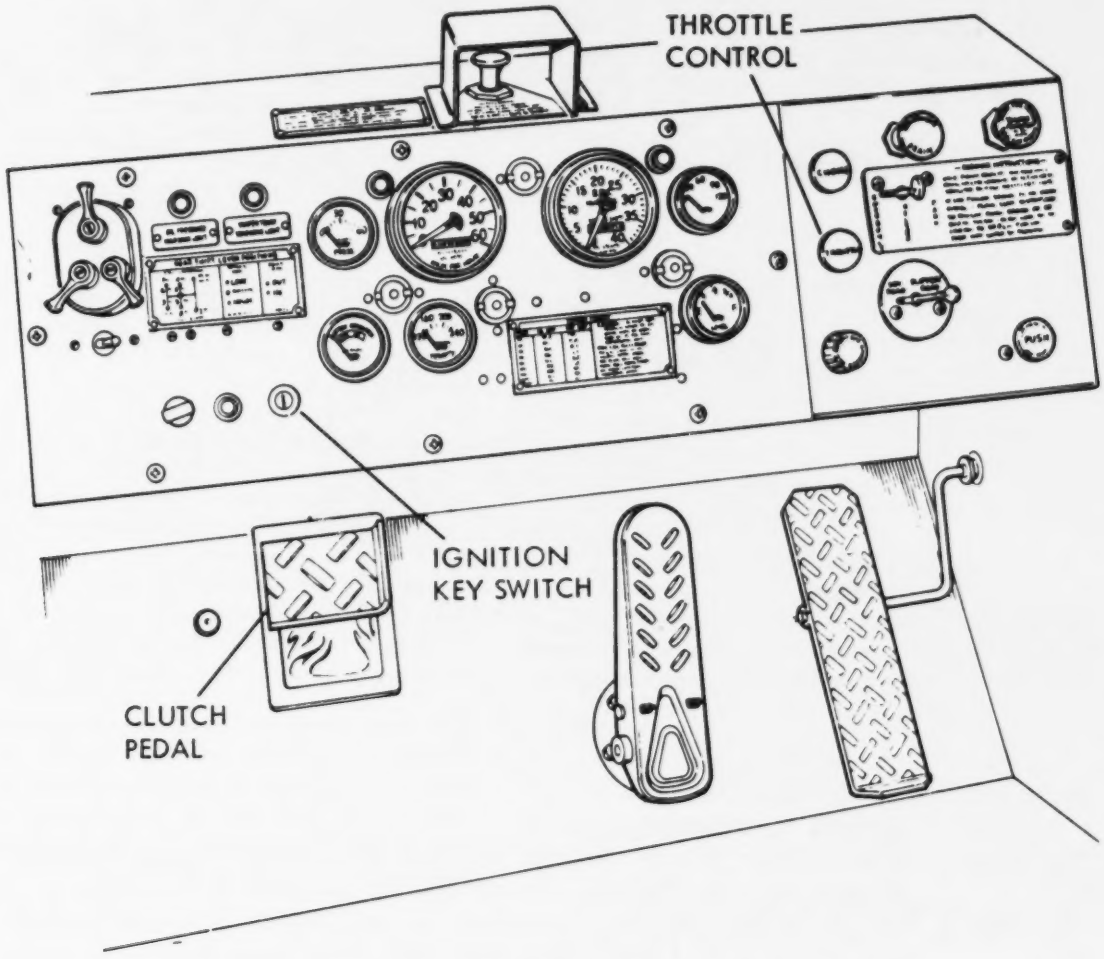

THROTTLE CONTROL
IGNITION KEY SWITCH
CLUTCH PEDAL
STEP 1. DEPRESS CLUTCH PEDAL.
STEP 2. DEPRESS THROTTLE CONTROL TO CLOSE THROTTLE.
STEP 3. TURN IGNITION SWITCH TO OFF POSITION.
STEP 4. RELEASE CLUTCH PEDAL.
ME 3810-294-10/5-3

Figure 5-3. Stopping the engine.

5-7. Operating the Carrier.

a. Start the engine (para 5-5).

b. Place the transfer case lever in the neutral position, and release the clutch pedal.

c. Place the EMERGENCY-RELEASE-PARK lever in the EMERGENCY position, and operate the engine at a fast idle (approx. 650 to 750 rpm) until the low air pressure warning flag retracts.

d. Depress the clutch pedal, and place the transfer case lever in the proper position (low or high range) as indicated on the gearshift nameplate. Make certain that the transmission shift button is depressed for operation in the low range.

Caution: Do not shift the transfer case while the carrier is in motion.

e. Release the clutch pedal to engage the clutch, while depressing the accelerator to increase the engine output, and drive off.

f. To shift the main transmission to the next higher gear, depress the clutch pedal, place the main transmission lever in the position indicated on the gear shift position nameplate, and release the clutch pedal. To shift into the main transmission high range, lift the transmission shift button.

g. To retard the motion of the carrier, remove pressure from the accelerator pedal. To bring the carrier to a stop, depress the brake treadle valve.

h. To hold the carrier brakes applied for short-term parking, bring the carrier to a stop, and place the brake three-way control lever in the EMERGENCY position.

i. To hold the carrier brakes applied for long-term parking, bring the carrier to a stop, and place the brake three-way control lever in the PARK position.

Section II. OPERATION OF AUXILIARY EQUIPMENT

5-8. Fire Extinguisher

See instructions in paragraph 2-22.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

5-9. Operation in Extreme Cold (Below 0°F, —18° C)

a. General. Operation in extreme cold presents special problems due to the increased possibility of condensation, and consequent freezing, and the increased difficulty of keeping parts lubricated adequately.

Warning: Personnel should use care to keep from spilling fuel, coolant, or other liquids upon themselves. Exposed parts of the body should not come into contact with metal during cold weather, as serious and painful injury may result.

b. Lubrication. See instructions in paragraph 2-23 b.

c. Cooling System. See instructions in paragraph 2-23 c.

d. Batteries. See instructions in paragraph 2-23 d.

e. Fuel System. Keep the fuel tank as full as possible at all times to minimize condensation. If the presence of water is noted in the fuel supply, drain the tank and refill it with clean fuel.

f. Starting. See instruction in paragraph 2-23 f.

g. Warmup.

(1) Cover part of the air passages through the radiator, to aid warmup and to maintain engine running temperature. During warmup only, the entire radiator may be covered.

(2) Place the transfer case shift lever in the neutral position, select a gear on the main transmission, and release the clutch pedal to turn over and warmup the main transmission.

h. Stopping. The park abort feature must be used in extremely cold weather to prevent the brakes from freezing up. Refer to paragraph 5-3.

5-10. Operation in Extreme Heat

See instructions in paragraph 2-24.

5-11. Operation in Dusty or Sandy Areas

a. General. Operation in dusty or sandy areas presents special problems due to abrasive action of dust which shortens the life of parts. Make every effort to keep dust and sand out of the engine, transmissions, and axles.

b. Lubrication. All lubricants and lubricating equipment must be kept clean. Service breathers and air cleaners frequently to remove sand and dust. Lubricate the entire carrier more frequently to keep a supply of clean lubricant at moving parts. Clean all lubrication fittings thoroughly before attaching the grease gun.

c. Fuel System. Keep the fuel tank filler cap tight to prevent sand or dust from entering the fuel tank. Service the fuel filters frequently to keep them free from sand and grit.

5-12. Operation in High Humidity or Salt Water Areas

See instructions in paragraph 2-26.

The park abort feature must be used in high humidity areas to prevent brakes from corroding and sticking to brake drums. Refer to paragraph 5-3.

5-13. Operation at High Altitudes

See instructions in paragraph 2-27.

CHAPTER 6

MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION

6-1. Lubrication Order (LO) Requirements

Refer to the current issue of LO 5-3810-294-12 for lubrication information.

6-2. General Lubrication Instructions

Refer to paragraph 3-2 for general lubrication instructions.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

6-3. General

To insure that the model M320T2 truck crane is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404 (equipment inspection and maintenance worksheet) at the earliest possible opportunity.

6-4. Preventive Maintenance Table

Refer to table 6-1 for a listing of preventive maintenance checks and services.

Table 6-1. Preventive Maintenance Checks and Services

B — Before Operation A — After Operation M — Monthly
D — During Operation W — Weekly Q — Quarterly

Item number	Interval: Operator: Daily B	Daily D	Daily A	Operator: W	Org.: M	Org.: Q	Item to be Inspected	Procedure	Reference
	X		X				FUEL SUPPLY	Keep tank full.	Figure 6-2
	X		X				RADIATOR	Fill to ½ inch above baffle plate.	Paragraph 6-15
				X			BATTERIES	Check electrolyte level and tightenss of connections. Fill to ⅜ inch (approx.) above the plates. In freezing weather, run the engine for one hour after adding water.	Paragraph 6-19
	X						FIRE EXTINGUISHER	Check for broken seal and correct weight	Paragraph 3-42
				X			HYDRAULIC STEERING RESERVOIR	Check level and add oil if necessary.	Figure 6-8
				X			AIR CLEANER	Check oil cup and clean if necessary.	Paragraph 6-10
	X						TIRE AIR PRESSURE	Check pressure. Pressure should be 75 psi.	Paragraph 6-31
	X						CONTROLS	With the unit running, operate each control and see that the control functions properly.	
	X	X					GAUGES AND INSTRUMENTS	Normal readings are: Coolant temperature - 160° to 200° F. Engine oil pressure - 35 to 45 psi Voltmeter Tachometer 3100 rpm (maximum)	Figure 2-33

Section III. TROUBLESHOOTING

6-5. General

This section provides information for diagnosing and correcting unsatisfactory operation or failure of the carrier portion of the model M320T2 truck crane. Included in this section is a troubleshooting procedure and references to field expedient repairs.

6-6. Troubleshooting

Malfunctions that may occur are listed in table 6-2. Each malfunction listed is followed by a test or inspection and the recommended corrective action.

Note. Malfunctions which are not included in this table will be reported to your supervisor.

Table 6-2. TROUBLESHOOTING

1. (MALFUNCTION) ENGINE WILL NOT CRANK OR START

Step 1. (Test) Check for corroded battery cables and / or terminals. Check for loose battery cables.
(Corrective Action) Clean cables and / or terminals.
Tighten cables.

Step 2. (Test) Check fuel level.
(Corrective Action) Fill fuel tank.

Step 3. (Test) Check air cleaner for restricted air intake.
(Corrective Action) Service air cleaner.

Step 4. (Test) Check the distributor cap to see if the interior is wet.
(Corrective Action) Dry interior of the distributor cap.

2. (MALFUNCTION) ENGINE OVERHEATS

Step 1. (Test) Check radiator coolant level.
(Corrective Action) Add coolant.

Step 2. (Test) Check for loose radiator hose connections.
(Corrective Action) Tighten any loose connections.

Step 3. (Test) Check engine oil level.
(Corrective Action) Add oil.

3. (MALFUNCTION) BATTERIES DISCHARGE WITH ENGINE RUNNING

Step 1. (Test) Inspect wiring and check for loose connections.
(Corrective Action) Tighten loose connections.

4. (MALFUNCTION) LOW OIL PRESSURE

Step 1. (Test) Check oil level.
(Corrective Action) Add oil.

5. (MALFUNCTION) EXCESSIVE OIL CONSUMPTION

Step 1. (Test) Inspect for oil leaks.
(Corrective Action) Check oil line and tighten loose connections.

6. (MALFUNCTION) INCORRECT AIR BRAKE SYSTEM PRESSURE

Step 1. (Test) Check for leaks in system.
(Corrective Action) Tighten loose connections.

7. (MALFUNCTION) ENGINE STALLS AT FULL LOAD

Step 1. (Test) Check to see if air cleaner is clogged.
(Corrective Action) Service air cleaner.

8. (MALFUNCTION) ENGINE "CUTS OUT" QUITE SUDDENLY UNDER LOAD

Step 1. (Test) Check for dirty fuel.
(Corrective Action) Drain and refill fuel tank.

9. (MALFUNCTION) ROUGH OR ERRATIC ENGINE IDLING

Step 1. (Test) Check to see if air cleaner is clogged.
(Corrective Action) Service air cleaner.

10. (MALFUNCTION) ENGINE KNOCKS

Step 1. (Test) Check for low octane fuel.
(Corrective Action) Use correct fuel.

11. (MALFUNCTION) HARD STEERING WITH VEHICLE MOVING

Step 1. (Test) Check to see if hydraulic fluid reservoir is too full.
(Corrective Action) Remove fluid until proper level is reached.

Table 6-2. TROUBLESHOOTING (Continued)

12. (MALFUNCTION) HARD STEERING WITH VEHICLE STANDING STILL

Step 1. (Test) Check to see if hydraulic fluid reservoir is too low.
(Corrective Action) Fill reservoir to proper level.

Step 2. (Test) Check for worn tires, wrong tire air pressure, unbalanced wheels, or misalignment.
(Corrective Action) Maintain proper tire air pressure.
Report other deficiencies to Organization Maintenance.

6-7. Field Expedient Repairs

Carrier field expedient repairs are identical to the crane (revolving frame) repairs. Refer to paragraph 3-7 and make temporary repairs as described.

Section IV. MAINTENANCE INSTRUCTIONS

6-8. General

The maintenance operations described in this section are those allocated to the operator / crew by the maintenance allocation chart (MAC). Maintenance functions are presented in the same groupings as listed in MAC. For example; all fuel system checks are grouped, all electrical system checks are grouped, etc.

6-9. Engine Inspection

Visually inspect the engine and engine accessories for fluid leaks or any other pnysical damage which would make it unsafe to start or run the engine.

6-10. Air Cleaner Service

Figure 6-1 illustrates the location of the carrier air cleaner. The carrier air cleaner is serviced in the same manner as the crane (revolving frame) air cleaner. Refer to paragraph 3-9 and service the carrier air cleaner.

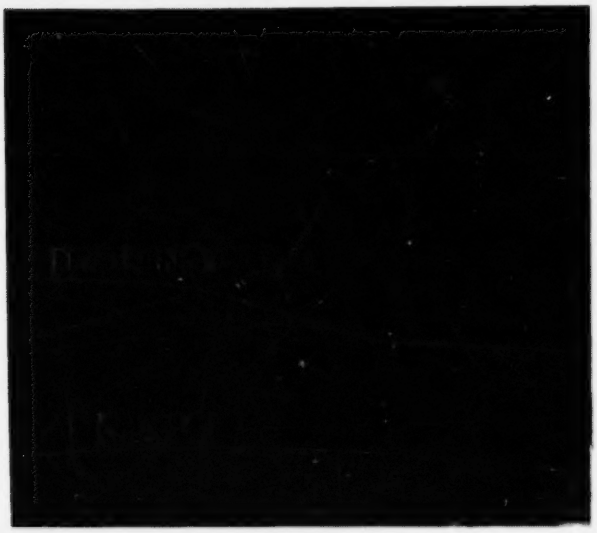


Figure 6-1. Air cleaner service.

6-11. Fuel Tank Service

The fuel tank should be kept as full as possible at all times to minimize condensation. Keep the fuel tank filler cap tight to prevent the entry of foreign material into the tank. Refer to figure 6-2 to fill the fuel tank. If water or other contamination is detected in the gasoline, refer to figure 6-2 and drain the fuel tank.

Warning: When refueling the model M320T2 truck crane, always provide a metal to metal contact between the filler nozzle and the gasoline tank. This will prevent sparks which might ignite fuel, and will thus prevent an unsafe condition which might destroy the machine or injure personnel.

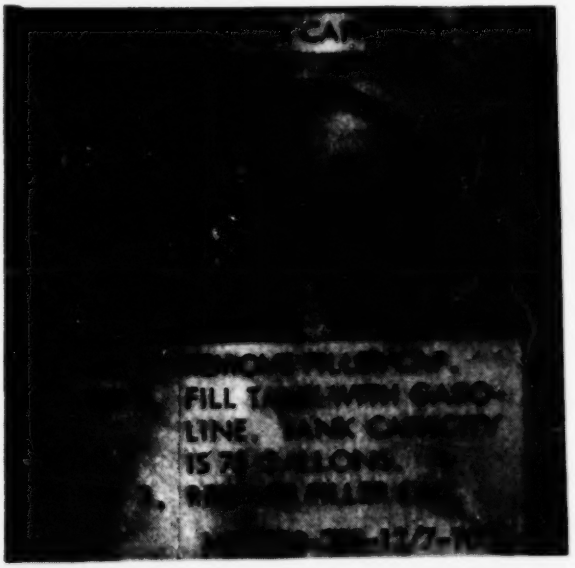


Figure 6-2. Fuel tank service (sheet 1 of 2).

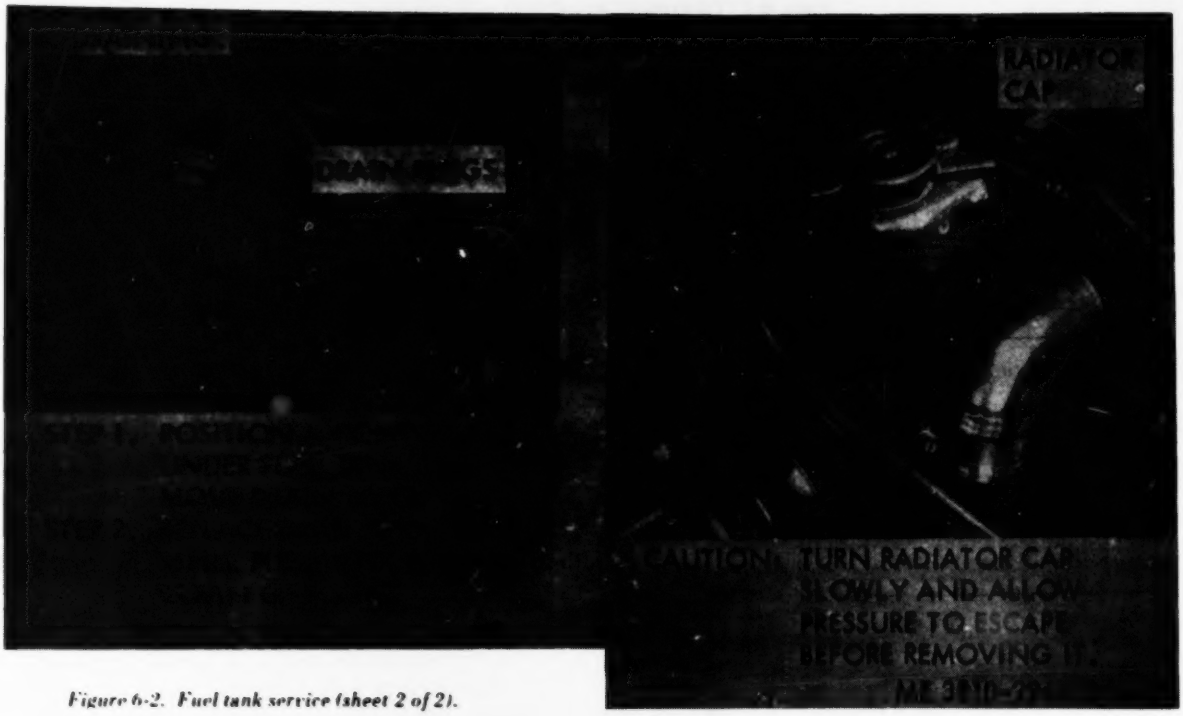


Figure 6-2. Fuel tank service (sheet 2 of 2).

6-12. Engine Control Panel Inspection

Inspect the engine control panel and panel gages for any obvious damage. During operation, monitor gages for proper operation.

6-13. Muffler and Pipe Inspection

Inspect muffler and pipes for damage, cracks, loose fittings, or other signs of deterioration.

6-14. Radiator Service

Figure 6-3 illustrates the radiator in the carrier of the machine. The carrier radiator is services in the same manner as the crane radiator. Refer to paragraph 3-15 and service the carrier radiator.

Caution: **Turn radiator cap slowly and allow pressure to escape before removing it.**

6-15. Fan Inspection

Inspect the fan for bent or otherwise damaged blades, loose mounting bolts, misalignment, or an unbalanced condition.

Figure 6-3. Radiator service.

6-16. Inspection of Lights

The inspection of the carrier lights is the same as the crane lights. Refer to paragraph 3-19 and inspect the lights on the carrier. During inspection, check switches for proper operation.

6-17. Inspection of Horns

The inspection of the carrier horn is the same as the crane horn. Refer to paragraph 3-20 and inspect the horn on the carrier.

6-18. Battery Inspection and Service

Figure 6-4 illustrates the batteries in the carrier of the machine. The inspection and service of the carrier batteries is identical to that of the crane batteries. Refer to paragraph 3-21 and inspect and service the carrier batteries.

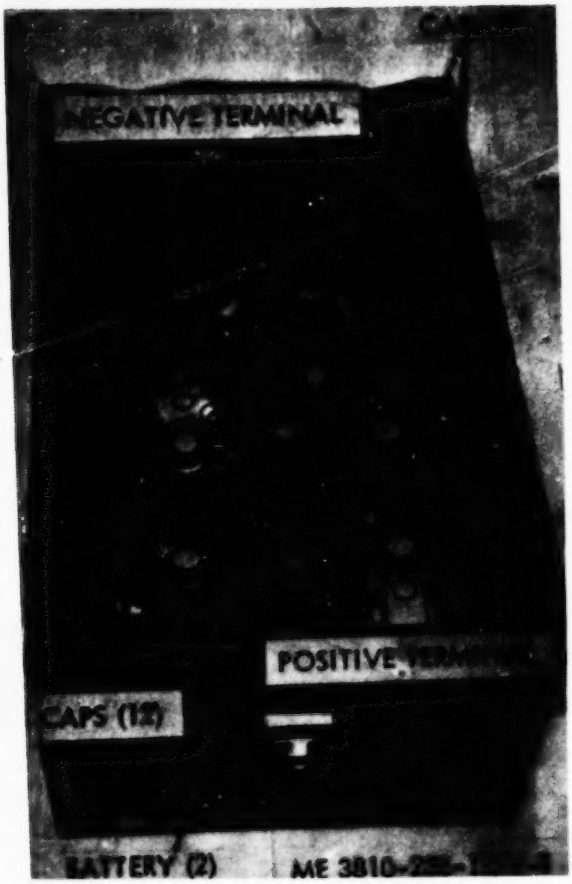


Figure 6-4. Battery inspection and service.

6-19. Trailer Coupling Inspection

There are two trailer couplings on the machine. One is mounted on the rear of the carrier frame and the other is mounted on the rear of the outrigger box. Inspect both couplings to insure that electrical connections are tight.

6-20. Transmission Inspection and Service

a. Inspection. Inspect the main transmission and drop box for leaks or other damage. A wet area usually indicates a leak, and should be traced to the source of the leak. Report all leaks or damage to Direct Support Maintenance. Check the oil level by removing the oil level plug. The oil should be just up to the oil level opening.

b. Service. Add oil of the type listed in the current LO, as required to bring the oil level just up to the oil level opening.

c. Air Filter Service. Refer to figure 6-5 and service the air filter located on the left side of the main transmission.

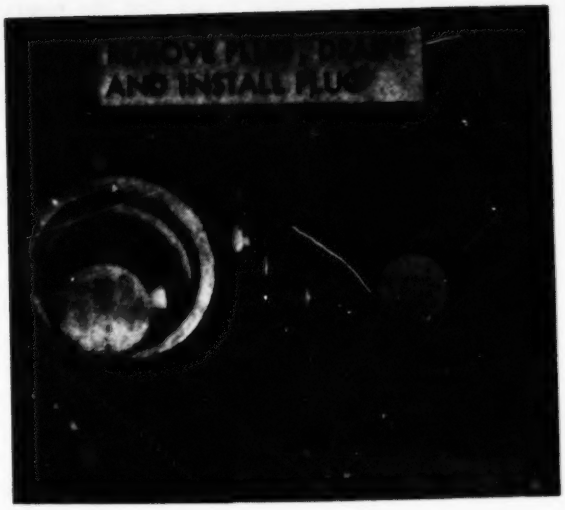


Figure 6-5. Air filter service.

6-21. Transfer Case Inspection and Service

a. Inspection. Inspect the transfer case for leaks or other damage. A wet area usually indicates a leak, and should be traced to the source of the leak. Report all leaks or damage to direct support maintenance. Check the oil level by removing the cap on the standpipe. The oil should be just below the end of the standpipe.

b. Service. Add oil of the type listed in the current LO through the standpipe until the oil level is just below the end of the standpipe.

6-22. Gear Shift Control Service

The servicing of the gear shift controls consists of checking the nuts and bolts on the gear shift control linkage to be sure that they are tight, and to lubricate the linkage pivots not equipped with grease fittings with OE.

6-23. Propeller Shaft Service

Lubricate the universal joints in accordance with the current LO.

6-24. Front and Rear Axle Inspection

Inspect the front and rear axles for grease or oil leaks or any other damage. A wet area usually indicates a leak, and should be traced to the source of the leak. Report all leaks and damage to direct support maintenance.

6-25. Differential Inspection

Inspect the area around the front and rear differentials for oil leaks and damage. Report all leaks and damage to general support maintenance. Check the oil levels by removing the oil level plug. The oil level should be just up to the oil level opening. Report low oil level to organizational maintenance.

6-26. Air Brake Reservoir Inspection

Check air brake reservoir to see that the reservoir has not been punctured. No reasonable possibility of corrosion or other external damage exists if the reservoir is kept properly painted. Report any deficiency to organizational maintenance.

6-27. Air Brake Hose and Fitting Inspection

Inspect all air brake hoses and pipes for leaks, kinks, worn areas, and breaks. Apply a solution of soapy water to all fittings and connectors of the air brake system and observe for leaks.

6-28. Air Compressor Inspection and Service

a. Inspection. Refer to figure 6-6 and inspect the air intake and discharge hoses, oil line, and cooling water lines for leaks, kinks, worn areas, or pinches. Inspect the air compressor mounting bolts to be sure they are tight. Inspect the drive belts to be sure they are properly alined and the belt tension is correct.

b. Service. Since the air compressor air intake is connected to the carrier air cleaner, and the compressor is lubricated and cooled by carrier engine oil and water, the only servicing necessary is keeping the air cleaner clean and the fluid levels in the engine and radiator properly maintained. Refer to paragraphs 6-10, 6-11 and 6-14.

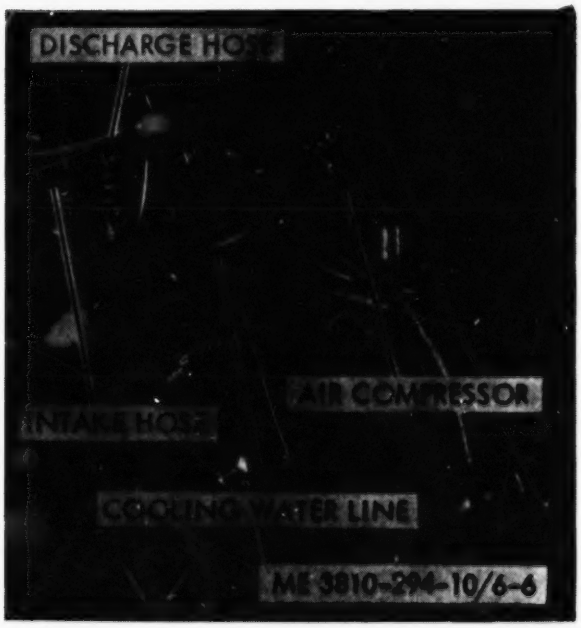


Figure 6-6. Air compressor inspection.

6-29. Wheel Inspection

Inspect the wheels for broken welds, bent or distorted beads, and loose wheel nuts. Report any deficiency to organizational maintenance.

6-30. Tire Inspection and Service

a. Inspection. Inspect all the tires in accordance with TM 9-1870-1.

b. Service. Remove any sharp objects wedged in the tire treads and check the air pressure in all the tires. The normal air pressure is 75 psi.

6-31. Tie Rod and Drag Link Service

Clean the area around the tie rod and drag link ends to prevent the entry of dirt into the tie rod and drag link ends. Lubricate the tie rods and drag link with the lubricant listed in the current LO, at the interval listed.

6-32. Hydraulic Pump Reservoir Service

Refer to figure 6-7 and service the hydraulic pump reservoir.

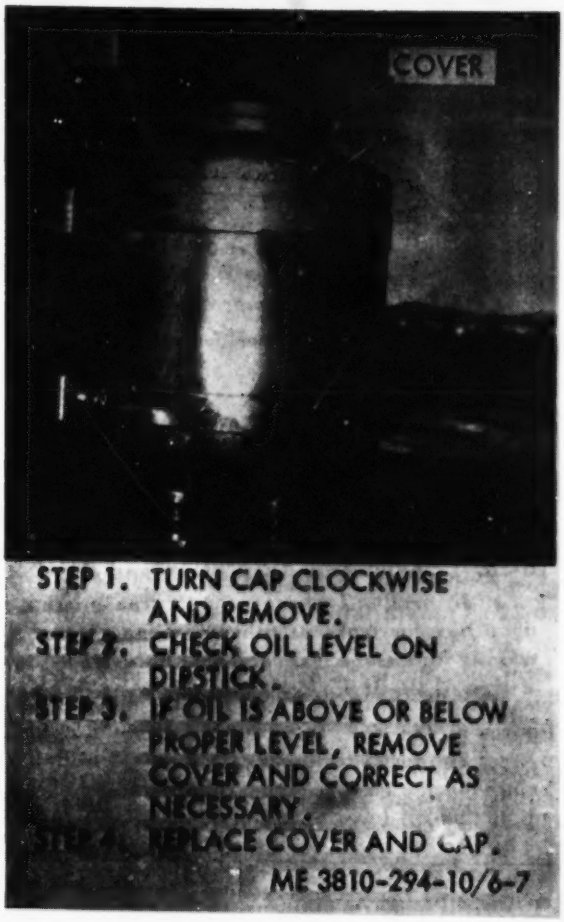

COVER
STEP 1. TURN CAP CLOCKWISE AND REMOVE.
STEP 2. CHECK OIL LEVEL ON DIPSTICK.
STEP 3. IF OIL IS ABOVE OR BELOW PROPER LEVEL, REMOVE COVER AND CORRECT AS NECESSARY.
STEP 4. REPLACE COVER AND CAP.
ME 3810-294-10/6-7

Figure 6-7. Hydraulic pump reservoir service.

6-33. Steering Wheel Inspection
Check for cracks or other visible damage. Check for excessive play in the steering wheel.

6-34. Steering Hose and Fitting Inspection
Check the hoses and fittings from the steering pump to the steering gear assembly (under the steering column) for leaks, worn areas, and loose connections.

6-35. Boom Rest Inspection
Check boom rest for rust, corrosion or damage. Check that the wooden boom rest support is not worn to the point that the boom hits the steel cross member when lowered.

6-36. Pintle Hook Service
Remove all rust and corrosion from the pintle hook and paint it in accordance with TM 9-213. Lubricate the hinge pin with the lubricant listed in the current LO, according to the interval also listed.

6-37. Outrigger Service
Refer to figure 6-8 and clean all rust and corrosion from the outrigger boxes, jackscrews, and jack floats. Paint the outrigger boxes and jack floats in accordance with TM 9-213. Lubricate the jackscrews with the lubricant listed in the current LO, according to the interval also listed.

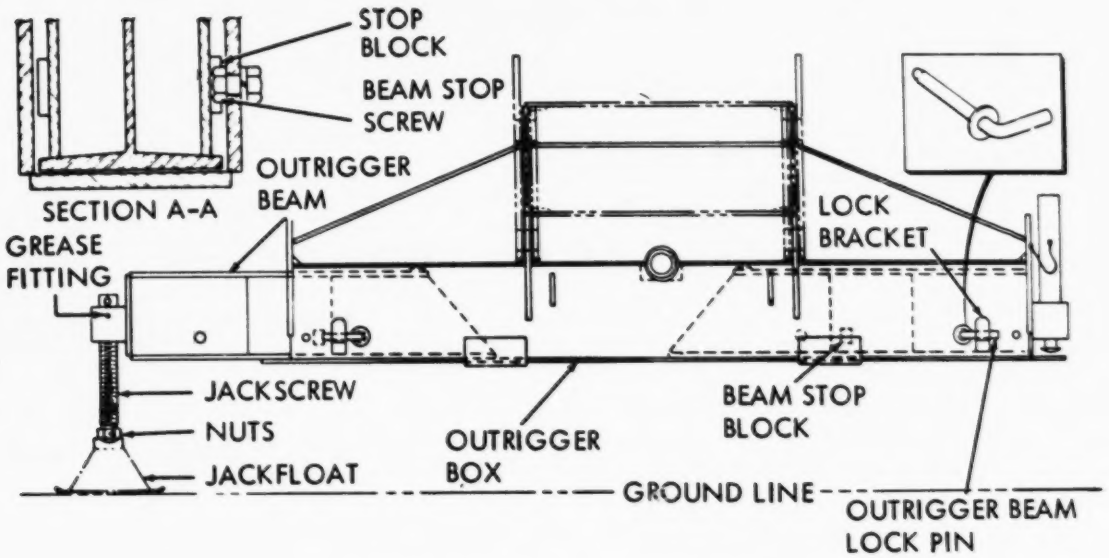


Figure 6-8. Outrigger service.

6-38. Shock Absorber Inspection
Check the rubber grommets on each shock absorber for excessive wear. When the vehicle is in motion, check for excessive bouncing. Report any deficiencies to organizational maintenance.

6-39. Data Plate Inspection
Inspect all data plates for readability, loose screws and nuts, or other physical damage. Report any deficiency to organizational maintenance.

6-40. Speedometer and Tachometer Drive Service
Check the tightness of the knurled nuts at each end of the speedometer and tachometer drive cables and tighten if necessary. Clean the end of the drive cables to prevent dirt from entering the cable housing.

6-41. Distributor (Ignitor) Service.
Refer to paragraph 3-16 for inspection and service of the distributor.

6-42. Fire Extinguisher Service
Service the carrier fire extinguisher in the same manner as the crane fire extinguisher. Refer to paragraph 3-42 and service the carrier fire extinguisher.

APPENDIX A

REFERENCES

A-1. Fire Protection	
TB 5-4200-200-10	Hand portable fire extinguisher for Army users.
A-2. Lubrication	
LO 5-3810-294-12	Lubrication Order.
C 9100IL	Fuels, Lubricants, Oil and Waxes.
A-3. Paint	
TM 9-213	Painting instructions for Field use.
A-4. Maintenance	
TM 9-1870-1	Care and maintenance of pneumatic tires.
TB 750-651	Use of antifreeze solutions and cleaning compounds in engine cooling system.
TM 38-750	The Army Maintenance Management System.
TM 9-6140-200-15	Operation and Organizational Field & Depot Maintenance, Storage Batteries, Lead Acid Type.
TB 385-101	Safety use of Cranes, Crane-Shovel.
A-5. Shipment and Storage	
TB 740-93-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage.
TM 740-90-1	Administrative Storage of Equipment.

APPENDIX B

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

B-1. Scope

This appendix lists items which accompany the truck crane model M320T2 or are required for installation, operation, operator's maintenance. Repair parts and special tools assigned maintenance code "C" in the -20P, organizational maintenance repair parts and special tools list, may be stocked at the operator level of maintenance when authorized by the Unit Commander.

B-2. General

This Basic Issue Items is divided into the following sections:

a. Basic Issue Items - Section II. A list of items which accompany the truck crane model M320T2 and are required by the operator / crew for installation, operation, or maintenance.

b. Maintenance and Operating Supplies - Section III. A listing of maintenance and operating supplies required for initial operation.

B-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II.

a. Source, Maintenance, and Recoverability Codes (SMR):

(1) Source code indicates the selection status and source for the listed item. Source codes are:

Code	*Explanation*
P	Repair parts which are stocked in or supplied from the GSA / DSA, or Army supply system and authorized for use at indicated maintenance categories.
P2	Repair parts which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
M	Repair parts which are not procured or stocked, but are to be manufactured in indicated maintenance levels.
A	Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies which are not procured or stocked and the mortality of which normally is below that of the applicable end item or component. The failure of such part or assembly should result in retirement of the end item from the supply system.
X1	Repair parts which are not procured or stocked. The requirement of such items will be filled by use of the next higher assembly or component.
X2	Repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain them through cannibalization. Where such repair parts are not obtainable through cannibalization, requirements will be requisitioned, with accompanying justification, through normal supply channels.
C	Repair parts authorized for local procurement. Where such repair parts are not obtainable from local procurement, requirements will be requisitioned through normal supply channels accompanied by a supporting statement of nonavailability from local procurement.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above GS and DS levels or returned to depot supply levels.

(2) Maintenance code indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	*Explanation*
C	Operator / Crew

(3) Recoverability code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	*Explanation*
R	Repair parts and assemblies which are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
S	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically repairable they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts are normally repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high dollar value reusable casings or castings.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required. The abbreviation "w / e", when used as a part of the nomenclature, indicates the Federal stock number includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parenthesis. Repair parts quantities included in kits, sets, and assemblies are shown in front of the repair part name.

d. Unit of Measure (U / M). A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit. This column indicates the quantity of the item used in the assembly group. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated (e.g., shims, spacers, etc.).

f. Quantity Furnished With Equipment. This column indicates the quantity of an item furnished with the equipment.

g. Illustration. This column is divided as follows:

(1) Figure number indicates the figure number of the illustration in which the item is shown.

(2) Item number indicates the callout number used to reference the item in the illustration.

B-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies-Section III.

a. Component Application. This column identified the component application of each maintenance or operating supply item.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the item name and brief description.

d. Quantity Required for Initial Operation. This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

e. Quantity Required for Eight Hours Operation. This column indicates the estimated quantities required for an average 8 hours of operation.

f. Notes. This column indicates informative notes keyed to data appearing in a preceding column.

Section II. BASIC ISSUE ITEMS

(1) SMR code	(2) Federal stock number	(3) Description Ref No. & Mfr Code — Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) Qty furn with equip	(7) Illustration (A) Fig No.	(7) Illustration (B) Item No.
PC	7520-559-9618	Case: Operations & Maintenance Manual	ea	1	1		
		Dept of Army Tech Manual TM 5-3810-294-10	ea	1	1		
		Dept of Army Lub Order LO 5-3810-294-12	ea	1	1		
PC	4210-889-2221	Extinguisher, Fire	ea	2	2		
PC	7510-889-3494	Binder, Loose Leaf	ea	1	1		
PC	2590-505-6736	Case Rifle	ea	2	2		

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required F Initial operation	(5) Quantity required F/O hrs operation	(6) Notes
AIR CLEANER		OIL LUBRICATING			(1) Includes quantity of oil to fill engine oil system as follows:
	9150-265-9435(2)	OE 30	(1)	(3)	
	9150-265-9428(2)	OE 10	(1)	(3)	
CRANKCASE	9150-242-7603(2)	OES	(1)	(3)	*Crane Engine:* 16 qts.
		OIL, LUBRICATING: 5 gal. can as follows:			*Carrier Engine:* 28 qts.
	9150-265-9435(2)	OE 30	(1)	(3)	*Carrier Air Cleaner:* 4 qts.
	9150-265-9428(2)	OE 10	(1)	(3)	*Crane Air Cleaner:* 2 qts.
DIFFERENTIALS	9150-242-7603(2)	OES	(1)	(3)	(2) See C91001L for additional data and requesting procedure.
		LUBRICATING OIL, GEAR: 5 gal. drum as follows:			
EXPOSED GEAR	9150-577-5847(2)	GO 140	(7)	(3)	
	9150-577-5844(2)	GO 90	(7)	(3)	(3) See current LO for grade application and replenishment intervals.
		LUBRICATING OIL, EXPOSED GEAR: 35 lb. pail as follows:			
GEAR AND CHAIN-CASE	9150-261-5197(2)	CW11-A	5 lbs.	(3)	(4) Fuel Tank capacities:
	9150-246-3276(2)	CW11-B	5 lbs.	(3)	*Crane:* 50 gals.
	9150-243-2918(2)	XW11-C	5 lbs.	(3)	*Carrier:* 75 gals.
GREASEPOINTS		LUBRICATING OIL, GEAR: 5 gal. can as follows:			(5) Average fuel consumption gal. per hour (GPH) of continuous operation:
	9150-577-5847(2)	GO 140	72 qt.	(3)	*Crane:* 7.5 GPH
HYDRAULIC CONTROL RESERVOIR	9150-577-5844(2)	GO 90	72 qt.	(3)	*Carrier:* 13.7 GPH
		GREASE, AUTOMATIVE AND ARTILLIARY: 35 lbs. pail as follows:			(6) Transmission capacities:
HYDRAULIC STEERING SYSTEM	9150-190-0907(2)	GAA			*Crane:* 3½ qts.
		BRAKE FLUID: automative 1 gal. can as follows:			*Carrier:* 8 qts.
POWER TRANSFER	9150-132-6375(2)	HBA	3 qts.	(3)	*Engine:* 4 qts.
		HYDRAULIC FLUID: 1 gal. can as follows:			(7) Front Axle 11 qts.
	9150-223-4134(2)	OHA	7 pts.	(3)	Rear Axle 11 qts.
		LUBRICATING OIL, GEAR: 5 gal drum as follows:			
RADIATOR	9150-577-5842(2)	GO 140	6½ qts.	(3)	
	9150-577-5844(2)	GO 90	6½ qts.	(3)	
		WATER: crane engine	38 qts.		
		WATER: carrier engine	60 qts.		
		ANTIFREEZE: 55 gal. drum as follows:			
	6850-243-1990	Ethylene Glycol			
		Crane Engine	24 qts.		
		Carrier Engine	36 qts.		
TANK, FUEL	6850-174-1806	ANTIFREEZE: compound arctic			
		Crane Engine	38 qts.		
		Carrier Engine	60 qts.		
		FUEL, GASOLINE: bulk as follows:			
	9130-160-1818(2)	Automative combat 91A	(4)	(5)	

Section III. MAINTENANCE AND OPERATING SUPPLIES

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required F initial operation	(5) Quantity required F/8 hrs operation	(6) Notes
TRANSMISSION		LUBRICATING OIL GEAR: 5 gal. drum as follows:			
	9150-577-5847G2	GO 140	(6)	(3)	
	9150-577-5844G2	GO 90	(6)	(3)	
	9150-257-5440G2	GOS	(6)	(3)	

By Order of the Secretary of the Army:

Official:

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Major General, United States Army,
The Adjutant General.

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